The Electrical Industry's Weekly Magazine

December 1, 1958

Electrical World

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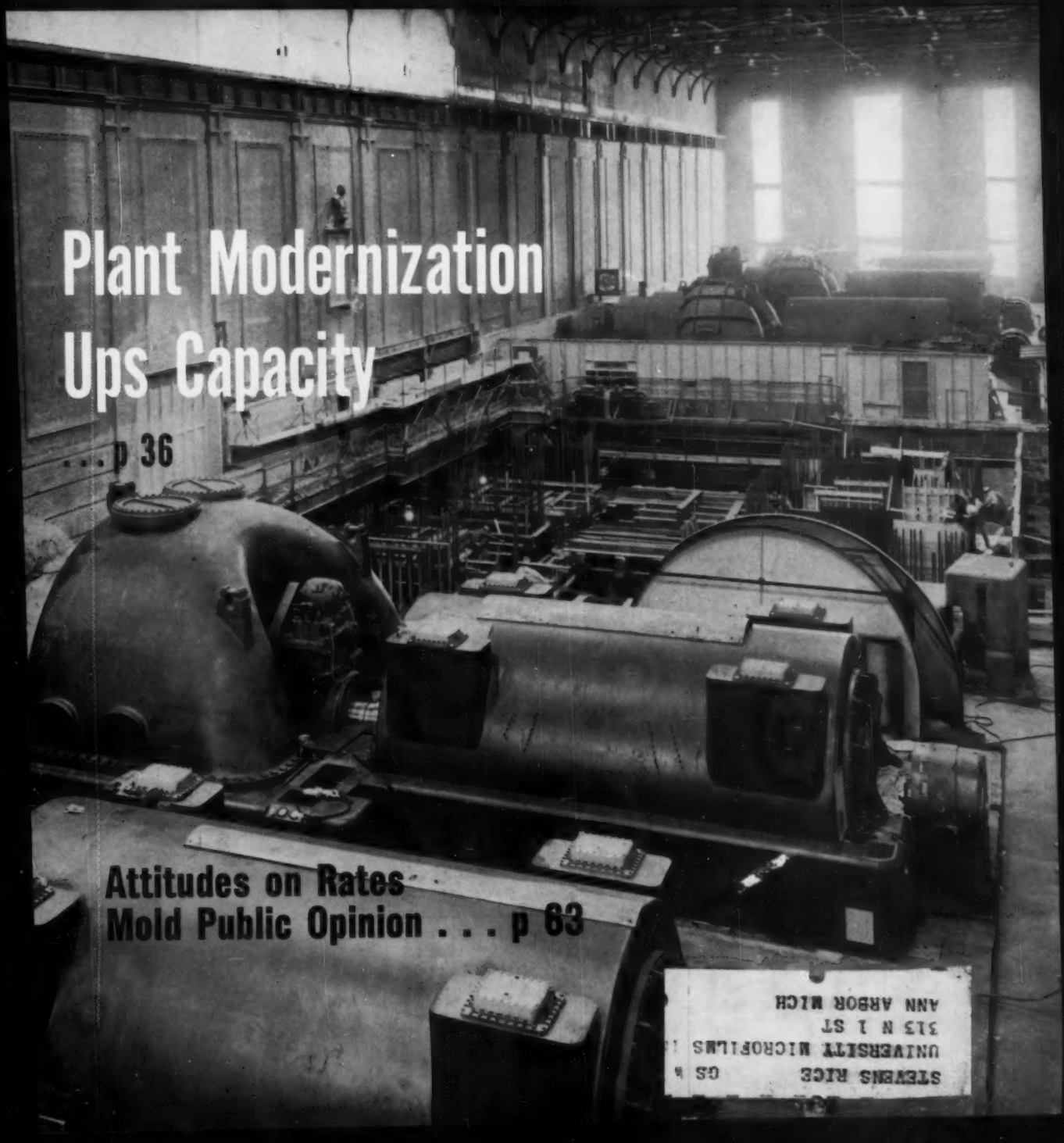

Plant Modernization Ups Capacity

. . . p 36

Attitudes on Rates Mold Public Opinion . . . p 63

STEVENS RICE GS
UNIVERSITY MICROFILMS
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ANN ARBOR MICH

HOW PROGRESS IN BUSHING STANDARDIZATION HELPS UTILITIES

New General Electric TBI* Bushings will lower utility inventory costs

Electric utilities can expect to save $5,000,000 in the next few years by cutting their bushing inventories as much as 75 percent. The savings will be the result of General Electric's company-wide effort to standardize on *only eight basic bushings* within the entire 23-kv to 196-kv ASA range. The new bushings will be directly interchangeable between power transformers, medium transformers and oil circuit breakers of the same voltage class.

The new standard transformer and circuit breaker bushings, called the TBI (Transformer Breaker Interchangeable) line, provide another weapon to fight inflationary cost trends. The TBI line will simplify ordering and stocking procedures by reducing the number of bushing ratings needed. This will permit electric utilities to reduce bushing inventories or to pool inventories within their system.

Only a manufacturer of both bushings and associated power apparatus could effect the standardization which the TBI line provides. By combining the engineering, research and manufacturing skill for its power transformers, circuit breakers and medium transformers, General Electric was able to achieve these extra values for the nation's utilities.

For more information on General Electric's TBI bushings, contact your nearest Apparatus Sales Office.

*Transformer Breaker Interchangeable. Tradename of the General Electric Co.

301-393

TBI

GENERAL ELECTRIC

MORE POWER TO AMERICA

GENERAL ELECTRIC

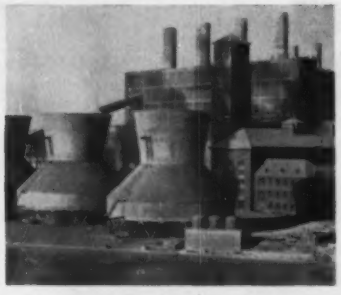
Electrical World

Vol. 150, No. 22 DECEMBER 1, 1958

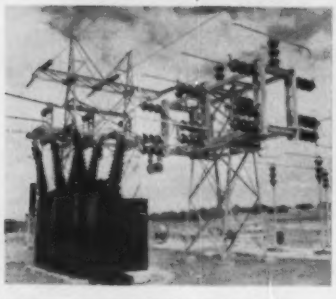
Published for 84 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

In This Week's Issue

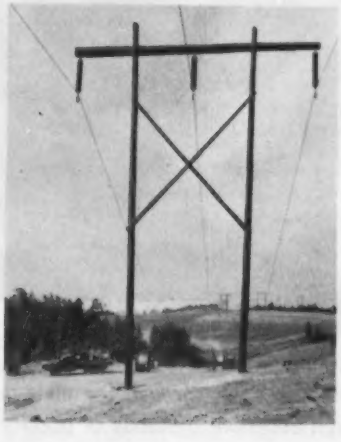
p 24



p 40



p 31



CURRENT EVENTS

West Germany: Power Paces Long-Term Boom

(First in series on foreign power developments)

With industry challenging Britain as runner-up to U. S., West German power prospects were never better.....p 24

GENERATION

Plant Modernization Increases Capacity

F. S. Helfter, Niagara Mohawk Power Corp

Niagara Mohawk gains fourfold increase by replacing old 25-cycle equipment with modern 200-Mw, 60-cycle units...p 36

MANAGEMENT NEWSLETTER

Rate Views Help Mold Public Opinion

Surveys show a link between customers' opinions of electric rates and their attitudes on public ownership.....p 63

SUBSTATIONS

Standard Structures Cut Substation Cost

M. A. Harkness, Public Service Co of N. M.

Modular approach makes possible easily laid-out, quickly erected, economical stations for New Mexico utility.....p 40

SYSTEM ENGINEERING

Compilers Ease Digital Programming

J. T. Carleton, C. J. Baldwin, Westinghouse Electric Corp

New compiler techniques bridge the gap between engineering and computer language, cut time and programming costs .....p 33

TRANSMISSION

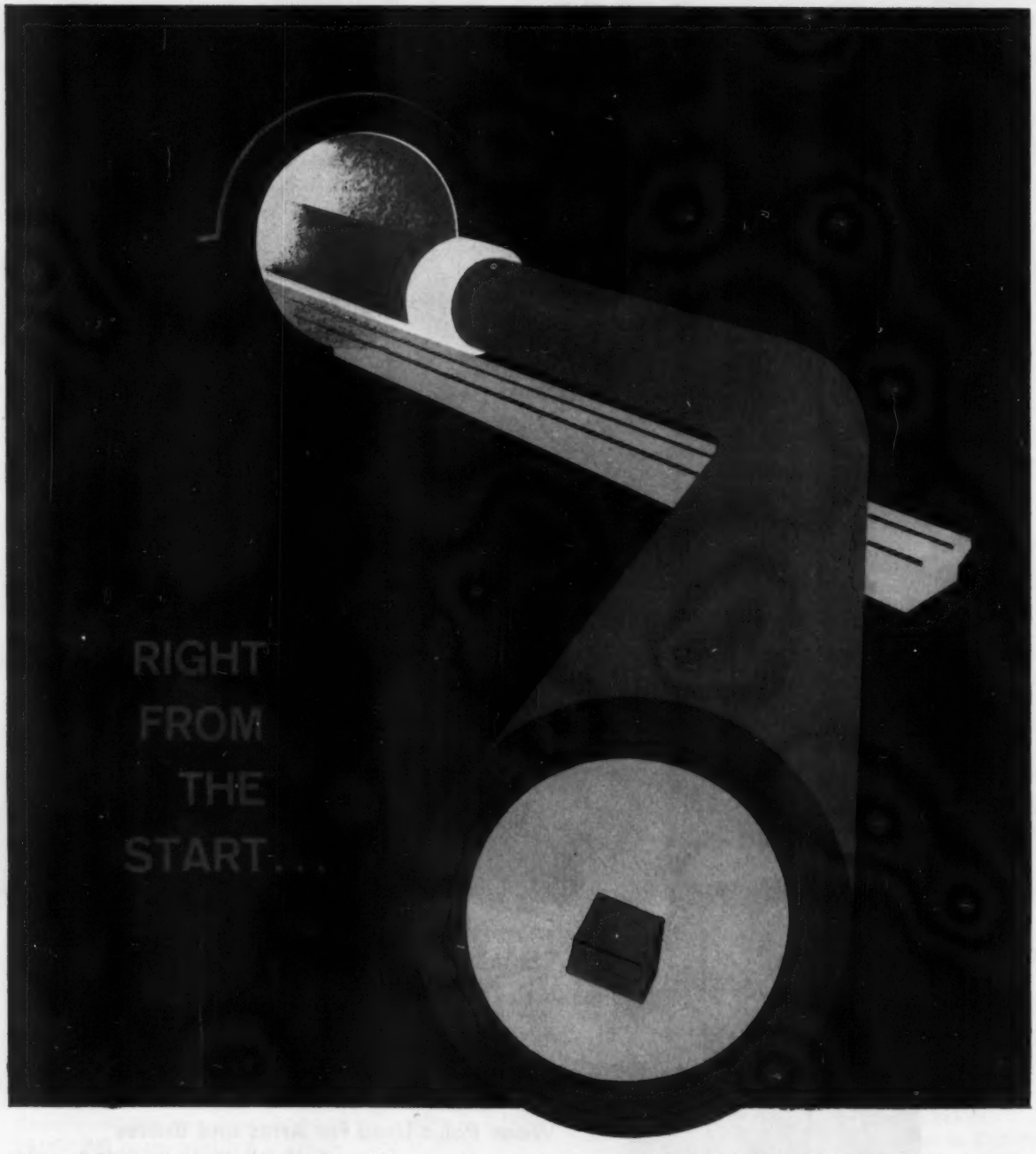
Wood Poles Used for Arms and Braces

Earl Baughn, Washington Water Power Co

230-Kv H-frame lines through Washington farmland built for $26,000 per mile; other savings also realized.....p 31

Departments

Editorials 23	How To 37	Readers Forum 84
• Electrical Week 11	• Management Newsletter ... 63	Readers Service 54
Engineering Reference Sheet 38	Manufacturers News 44	Selling 58
Executive Reader 14	New Equipment 48	INDEX TO ADVERTISERS... 84
From the Publisher..... 5	News About People..... 72	



When piping costs come close to the million mark — when the installation is vast, and the leeway for error is small — a piping job must be right from the start to finish. Grinnell assures this through complete one-company control and responsibility. From interpretive engineering — through exclusive methods of prefabrication and testing of pipe and hanger units — to precision assembly and delivery, the job is all done by Grinnell, as only Grinnell can do it. The result: installations of any size, at costs known before you start, with assured performance. Grinnell Company, Inc., Providence, R.I.

Current Grinnell piping responsibilities. Enrico Fermi Atomic Power Plant, Michigan; Ohio Power Company, West Virginia; National Aniline Division of Allied Chemical & Dye Corporation, Virginia; Memphis Light, Gas and Water Division, Tennessee; Aluminum Company of America, Indiana; South Carolina Electric & Gas Company, South Carolina; Duke Power Company, North Carolina; Union Bag-Camp Paper Corp., Virginia; Pennsylvania Power & Light Company, Pennsylvania; Holyoke Water Power Company, Massachusetts

GRINNELL

The Exciting Revolution

Extensive legwork and patient research of Morrie Helitzer, 33-year-old chief of McGraw-Hill's Bonn news bureau, have produced the article beginning on page 24. It puts into clear perspective the amazing growth of Western Germany's electric utility industry since World War II and its future potential.

Helitzer, an EE graduate (Cornell-'45) with a masters in political science (U. of Chicago-'48), describes highlights of the technical and economic revolution in Western Germany's electric utility industry.

But Western Germany is no exception. Virtually the whole world is embarked on a fast-paced development of energy sources. This development hinges on greater electrification.

We believe that for many in the U. S.—where the phenomenon now would more accurately be termed "evolutionary"—a description of the challenges and achievements in other countries can provide new ideas and incentives. This is one of Electrical World's primary aims in bringing to you a series of stories profiling the power developments of this exciting electrical world.

Fischer Black

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Dallas Power & Light Co. uses Lapp 4288 Clamp-Top Line Posts to carry 60 kv through the residential areas of Dallas, Texas.

60 kv Transmission with a "Low Voltage" Look

Is your residential system having growing pains? Substations near new load centers may solve your problems if you can run a subtransmission line through residential areas without consumer objection.

There's a proved way to do it. You can run a line at 69 kv, or even higher, on "small" wood pole structures with single crossarms—and compact, sturdy Lapp Line Posts. Such a line will have the unobtrusive look of a distribution line, will be free of RIV and TV interference, and will save you money on initial cost—and trouble-free long life.

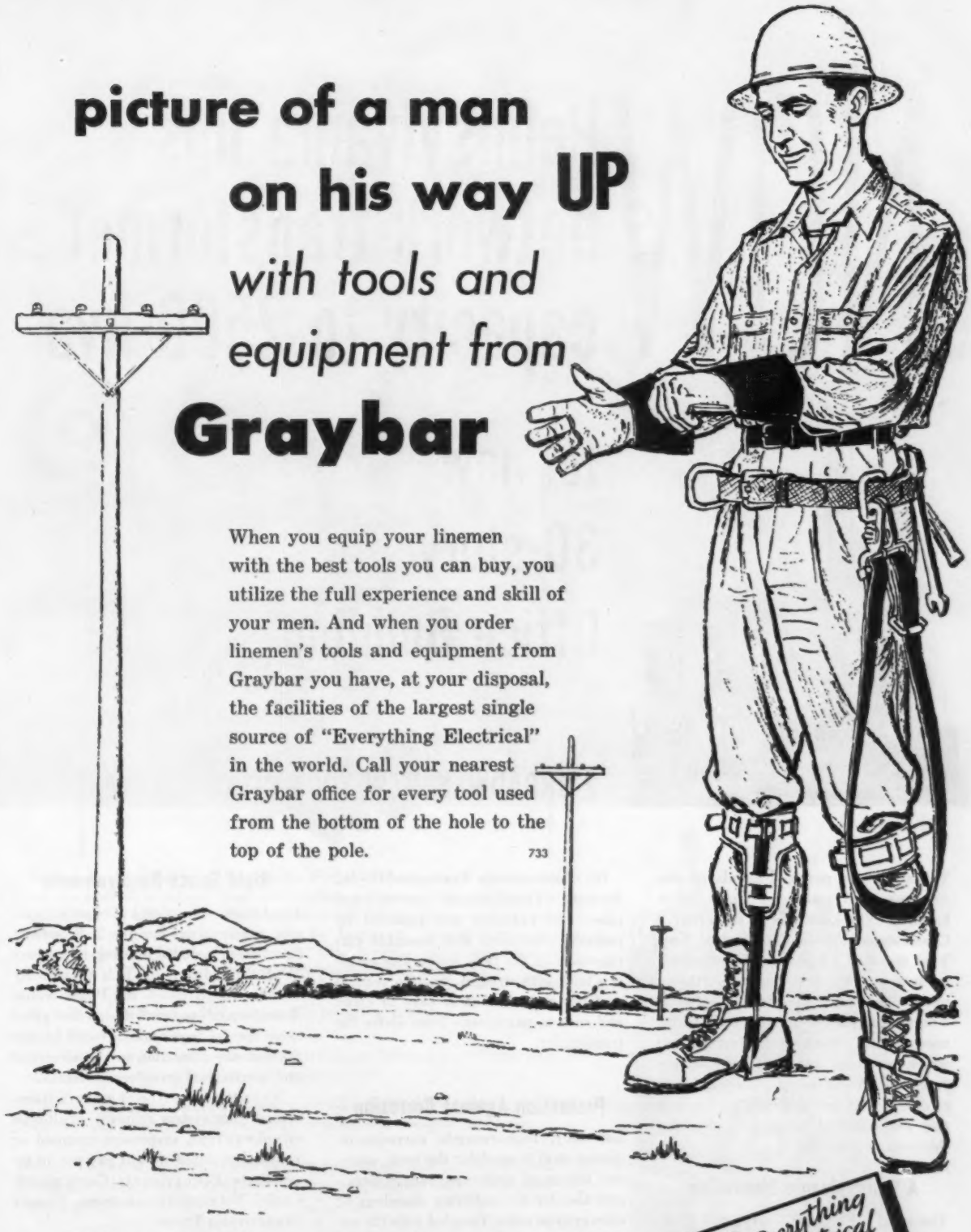
Once you've built such a line your future problems diminish, too. With one installation —good looking, high-performance, complaint-free—it will be easier to get rights-of-way for future transmission lines. Lapp Line Posts, either with tie-wire head or clamp-top, are available in voltage ratings through 88 kv.

Lapp Insulator Co., Inc., Le Roy, N. Y.

picture of a man on his way UP

with tools and equipment from

Graybar



When you equip your linemen with the best tools you can buy, you utilize the full experience and skill of your men. And when you order linemen's tools and equipment from Graybar you have, at your disposal, the facilities of the largest single source of "Everything Electrical" in the world. Call your nearest Graybar office for every tool used from the bottom of the hole to the top of the pole. 733

Call Graybar first for...

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GRAYBAR Everything Electrical GRAYBAR ELECTRIC COMPANY

IN OVER 130 PRINCIPAL CITIES

NOW Pennsylvania ups network transformer capacity to 2500 kva

for new 30-story Office Building

2 BROADWAY, NEW YORK CITY

To satisfy the power demands of the spacious, fully air-conditioned office building to be known as "2 Broadway," Consolidated Edison Company of New York specified a higher-than-ever capacity in network transformers. Six three-phase, 2500-kva Pennsylvania Network Transformers are among the eight being used in this record-setting installation, which provides 265/460Y-volt service from 13750Δ-volt feeders. There are four oil-filled units for sidewalk vaults, and two askarel-filled units for atop the thirty-story structure.

A Pennsylvania Innovation

The units all feature Corrugated Cooling—a Pennsylvania innovation of several years back that has stimulated industry-wide changes in network transformer design.

On Pennsylvania Corrugated-Cooled Network Transformers, conventional tubes and radiators are replaced by radiating chambers that resemble corrugations in the tank walls. The result is a tank with straight, smooth, vertical surfaces—a tank that is easy to clean and easy to paint, even from above the transformer.

Protection Against Corrosion

Low-alloy, high-strength, corrosion-resistant steel is used for the tank, cover, and bottom of vault-type transformers—and also for the radiating chambers of subway-type units. Coupled with the exceptional ease of maintenance and inspection made possible by Corrugated Cooling, this provides highly effective protection against corrosion.

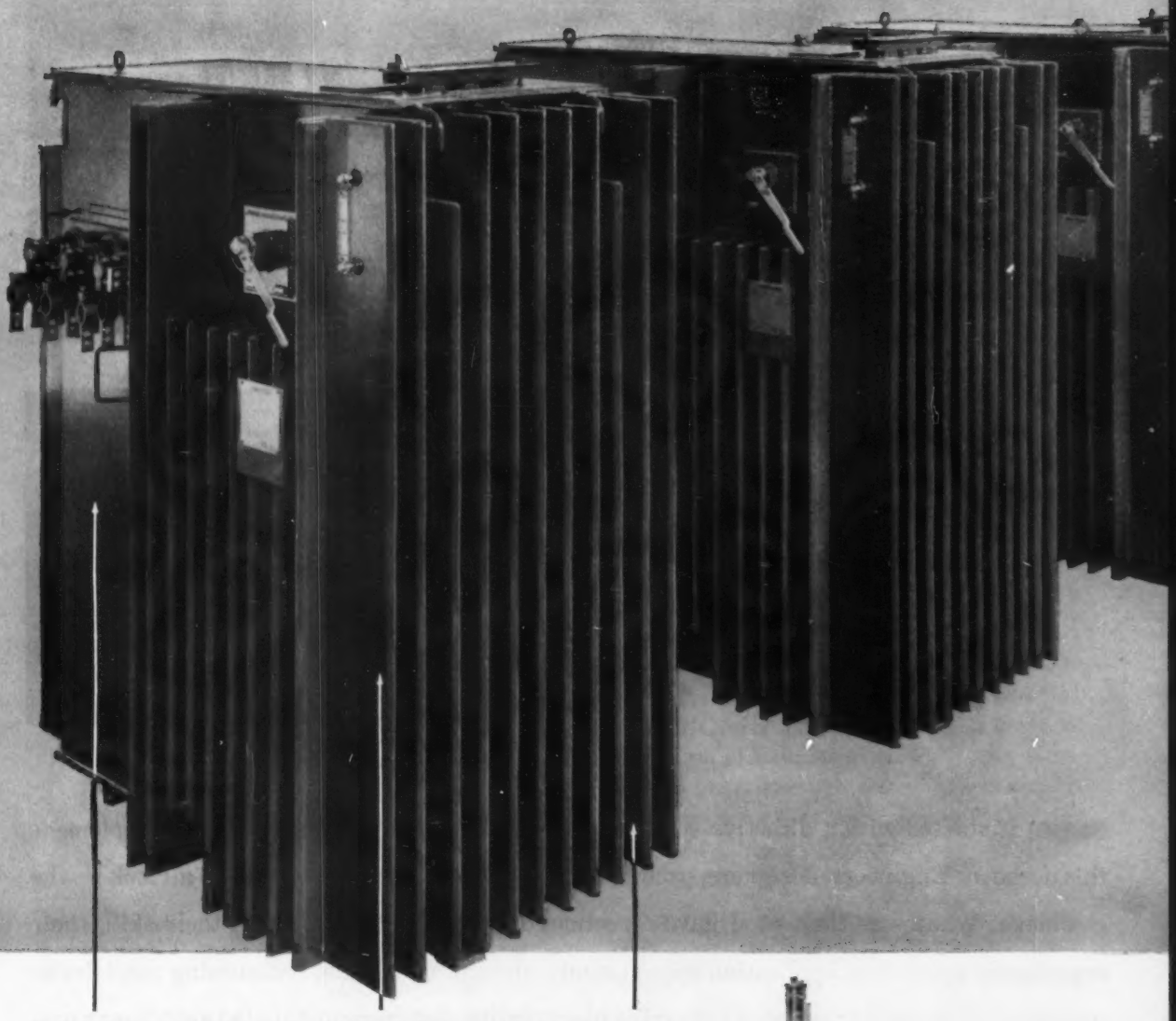
Rigid Space Requirements

In addition to the 2500-kva capacity, special requirements for the 2 Broadway installation included limiting dimensions in all three directions. It is a testimony to the effectiveness of Pennsylvania Transformer's network design that all of these special requirements could be met without any alteration in the electrical and mechanical transformer details.

No matter what type of network transformer your system requires—vault-type or subway-type, suspension-mounted or pedestal-mounted—it will pay you to investigate Pennsylvania Corrugated-Cooled Network Transformers. Contact Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pennsylvania.

CORRUGATED COOLING

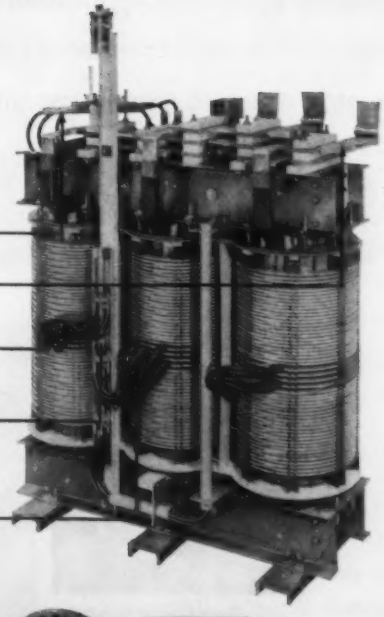
PENNSYLVANIA POWER



Tank shell, cover and bottom are made of low-alloy, high-strength, corrosion-resistant steel—used also for radiating chambers of subway units.

Corrugation-like radiating chambers replace hard-to-clean radiators and tubes. There are no ledges or crevices on which corrosive materials might collect.

Liberal spacing of radiating chambers facilitates maintenance. Transformer is easy to clean and paint, even from above.



High voltage leads are rigidly supported in insulating tubing.

Low voltage bus bars are interleaved to keep copper losses to a minimum. Bars are supported between maple blocks and insulating pads.

Taps are arranged to assure electrical and mechanical balance in the high voltage windings and to minimize the impedance variation over the entire tap range.

Rotary no-load tap changer cannot hang up between contacts. Entire tap changer is housed in a half tube of Pennsylite® to assure adequate vertical insulation phase-to-phase and phase-to-ground.

Pancake-type high voltage coils provide exceptional mechanical strength. In addition, coils are precompressed to pressure equal to maximum short circuit forces that might occur. No additional distortion or displacement can take place.

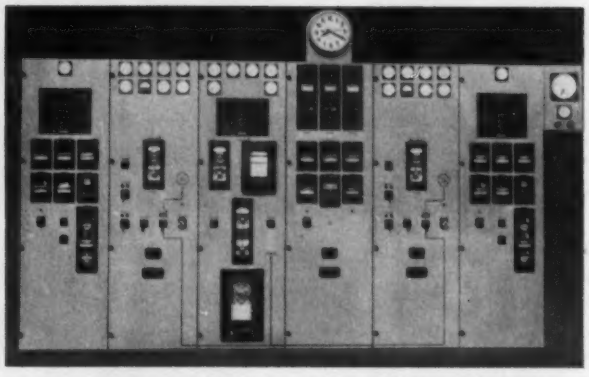
TRANSFORMERS

McGRAW EDISON

in metal-clad switchgear...

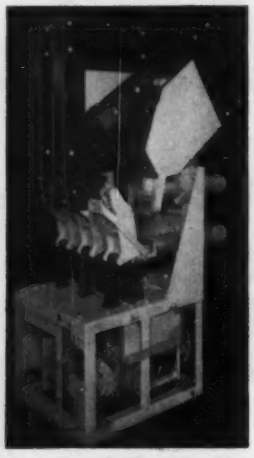
Reliability

is born of many men's efforts



Indoor metal-clad power plant switchgear rated 4160 volts, 3 phase, 60 cycles supplied to a partially attended generating station.

It started with a directive—"Make it the best!" A creative team set out to implement this decision. Engineers, designers, production men, and marketing personnel—all took up the challenge. What was *then* good gave direction. They added their talents, their skill, their experience—up-to-date application requirements—designing, testing, redesigning until drawing board plans were translated to market place reality. Out came metal-clad switchgear preeminent in strength, simplicity, and performance. They *had* made it the best!



Type DST air circuit breaker—5 kv, 250 mva, 1200 amps.

From simple feeder circuits to complex generating station protection—when you specify Federal Pacific metal-clad switchgear, you specify reliability. Proof is yours for the asking. Write Federal Pacific Electric Company, Newark, New Jersey for Catalog 3-440—sixty-four pages of the latest in metal-clad switchgear information.

FEDERAL FPE PACIFIC

The Best in Electrical Distribution and Control Equipment

The Electrical Week

FUTURE NEWS ▶ **Watch for report on electric vs gas services** for multiple housing in late December. EEI Board will review report Dec. 9.

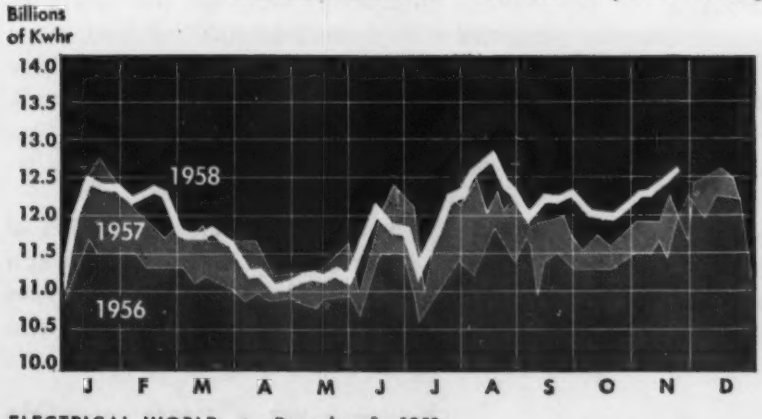
LATE NEWS ▶ **Allis-Chalmers officials protested to TVA's board,** last week, impending award of three 60,000-kva hydro generators to Brown Boveri, evaluated low bidder among six firms. Allis VP J. L. Singleton charged award would deprive U.S. labor of work, impair living standard, and tax revenues. TVA spokesman said its board had not received purchasing staff recommendation on the units. Unevaluated bids, in millions, valid till 11/28: Brown Boveri, $2.639; American Elin, $2.542; English Electric, $3.103; Allis-Chalmers, $4.290; Westinghouse $4.495, and Elliott $4.654. G.E. protested specifications, didn't bid.

NRECA legislative objectives are called into review by a resolution at recent annual meeting of the National Association of Railroad and Utilities Commissioners. NARUC says Ellis' objectives "appear to constitute an unwarranted invasion of state regulation . . . may abrogate the prerogatives inherently guaranteed to the several states by constitutional provision, and . . . may be inimical to the best interests of the public generally" . . . NARUC also passed a resolution condemning the IRS ECAP-tax ruling.

Late off the Washington Wire . . . Sen Neuberger (D-Ore.) has released the draft of his new bill to create a valley-type Columbia River Development Corp, replacing BPA . . . National Labor Relations Board has ruled it will assert jurisdiction over public utilities doing a gross of more than $250,000 a year, or having a flow of goods or services across state lines of $50,000 or more per year.

Management changes . . . Vepco elects B. J. Dorsey vp, effective Jan. 1 . . . Kansas P&L names two vp's: B. S. Cohn and J. G. Williamson.

POWER OUTPUT—UP 3.7% (Week ending Nov. 22), Kwhr 12,579,000,000



Per Cent Change From Previous Year

	Nov. 8	Nov. 15	Nov. 22
Total U. S. ...	+3.3	+3.6	+3.7
New Eng.	+6.0	+7.1	+8.6
Mid. Atlantic..	+3.4	+3.2	+3.3
Cent. Ind. ...	+2.9	+2.4	+1.5
West Cent. ...	+2.2	+3.5	+3.2
Southeast	+2.7	+1.7	+1.5
South Cent. ..	+5.1	+9.3	+8.2
Rocky Mount..	+5.9	+8.1	+7.0
Pacific			
NW	−0.2	+1.2	+4.1
SW	+5.5	+6.1	+8.5

Seasonally Adjusted Index 237.1

Week Ago 236.8 Year Ago 228.3

Source: Edison Electric Institute

A TWO-MINUTE PREVIEW OF THIS ISSUE

EVENTS ▶ **Four factors are behind West Germany's rapid advance** of her electric utility industry: 1. Good planning, particularly on a 400-kv grid. 2. An advanced technology that has shifted from mechanical to electrical engineering for sinews of industry. 3. Rich sources of coal utilized in big block units and ample water for both new and old pumped-storage projects. 4. The unabated demand of industry paired with awakened consumer demand for appliances (p 24).

Fifty-one power companies offer to build gas-cooled reactor in 11th-hour bid to the Atomic Energy Commission. Spearheaded by Philadelphia Electric Co, the 40-Mw, $25-million project is the only private bid received by AEC. The 51 companies formed a new group, High Temperature Reactor Development Associates, Inc, to make the offer. AEC will have to decide whether or not it is satisfactory; but it appears as though Chairman McCone will snap it up (p 27).

Euclid, Ohio is ordered to permit CEI overhead construction of 132 kv lines. City plans a state supreme court appeal (p 28).

A tightened licensing procedure for hydro projects is proposed by FPC Chairman Kuykendall. It would affect operators of newly licensed 20-year-old dams and unlicensed operators (p 69).

GENERATION ▶ **Modernization quadruples capacity of Huntley Station,** bringing substantial savings to Niagara Mohawk. Company chopped the middle out of Huntley without shutting down the ends, replaced 95 Mw of old 25-cycle capacity with two new 60-cycle units rated 200 Mw each. Cost: $57 million. Here's how they did it (p 26).

SUBSTATIONS ▶ **Low cost substations and switching stations are erected quickly** by Public Service Co of New Mexico, using a modular approach. PS Co designed three standard steel structures—deadend tower, disconnect tower, and insulator support column—adapts them for use in its various 115-kv stations. Five-circuit, five-breaker switching station costs $120,000 per breaker using these components (p 40).

COMPUTERS ▶ **Compilers spearhead dramatic advances in computer programming,** by bridging the gap between engineering language and computer language. Compiler programs will: minimize errors, cut costs, allow utility engineers to make greater use of computers by cutting machine time, and open the way to solution of complex, one-time problems. Here's what the "Fortran" compiler can do and how it works, explained by two Westinghouse engineers (p 33).

TRANSMISSION ▶ **Woodpole arms and braces** carry a 230-kv line across 106 miles of farmland in Washington Water Power country. Line was built at a cost of $26,000 per mile, including right-of-way. Using larch poles instead of spar arms and square-sawed crossbraces cut materials cost

in half without adding to labor outlay. For design information and detail drawings, turn to **p 31.**

MEETING ▶ **Southeastern Electric Exchange engineers examined future needs** at the Roanoke, Va., meeting of SEE's Engineering & Operating Section. They heard predictions of higher secondary voltages, underground residential distribution circuits, underground dc transmission, compact 1,000-Mva generating units, and many other changes in the electric system of tomorrow, as well as a description of GE's Operations "Know How" and "Sunrise." Full meeting report begins on **p 30.**

MANAGEMENT ▶ **Customers' opinions on electric rates may determine how they feel** about the whole question of public ownership of utilities, according to data collected by Central Surveys, Inc. Here's a report on trends in public opinion affecting the power companies, and some advice on how to improve your public relations **(p 63)** . . . A 42-company sample of electric utility income statements shows an average year-to-year rise in net income of 9.2% for the twelve months period ending Sept. 30 **(p 65).**

SELLING ▶ **A diner in Thorndale, Pa., goes all-electric.** It helps to provide increased dining enjoyment for its customers . . . Look Magazine releases entry blanks for Fifth Wiring Promotion Awards **(p 58).**

MANUFACTURERS ▶ **To link Westinghouse Electric's 102 plants and 142 sales offices,** the company has installed a fully automatic communication system . . . Delta-Star Electric Division of H. K. Porter Co is running tests on telescopic, isolated-phase buses . . . Panel-lit, Inc, is designing and building an electronic control system for use by Consolidated Edison Co of New York at Indian Point **(p 44).**

NEW EQUIPMENT ▶ **To provide automatic regulation in 32 steps of 5/8% each,** a manufacturer has voltage regulators in 27 distribution regulators . . . A plastic spacer is a feature of new overhead distribution system . . . Transformer enclosures house conventional pole-type single-phase transformers rated through 50 kva **(p 48).**

PEOPLE ▶ **Eldon A. Werner is new vp of Gulf States Utilities Co.** John J. Morrison is executive vice president, and Ralph E. Cargill, vice president in charge of engineering, transmission, and distribution, have been assigned new duties. Morrison will be involved in the general operation of the utility's system; Cargill will assume power production responsibility . . . Federal Pacific Electric Co has named Robert L. Bobo vice president-marketing and Harry E. Knudson, Jr. general sales manager . . . Glenn Mitchell has become president of Southern States Equipment Corp. W. C. Mitchell is the new vice president and treasurer, and Olan Richardson, former president, becomes chairman of the board **(p 72).**

Gas has established a beachhead in the residential air-conditioning field. Sales efforts now are being concentrated on gas-heated homes and on the more than 1 million new homes being built annually. **G. T. Kellogg, Public Utilities Fortnightly, Oct 23, 1958.**

TECHNICAL NOTES

Placing the boiler feed pump ahead of the heaters results in a saving of pumping power. The shaft sealing problem also is simplified. On the other hand the heaters operate at higher pressures. This not only adds to the first cost of heaters, valves and piping, but also subjects them to much more severe operating conditions.

Voltage distribution in a HV dc cable depends upon the resistances of the different insulating layers which in turn depend upon the temperature. Thus, voltage distribution in the dielectric changes substantially with thermal conditions in the cable.

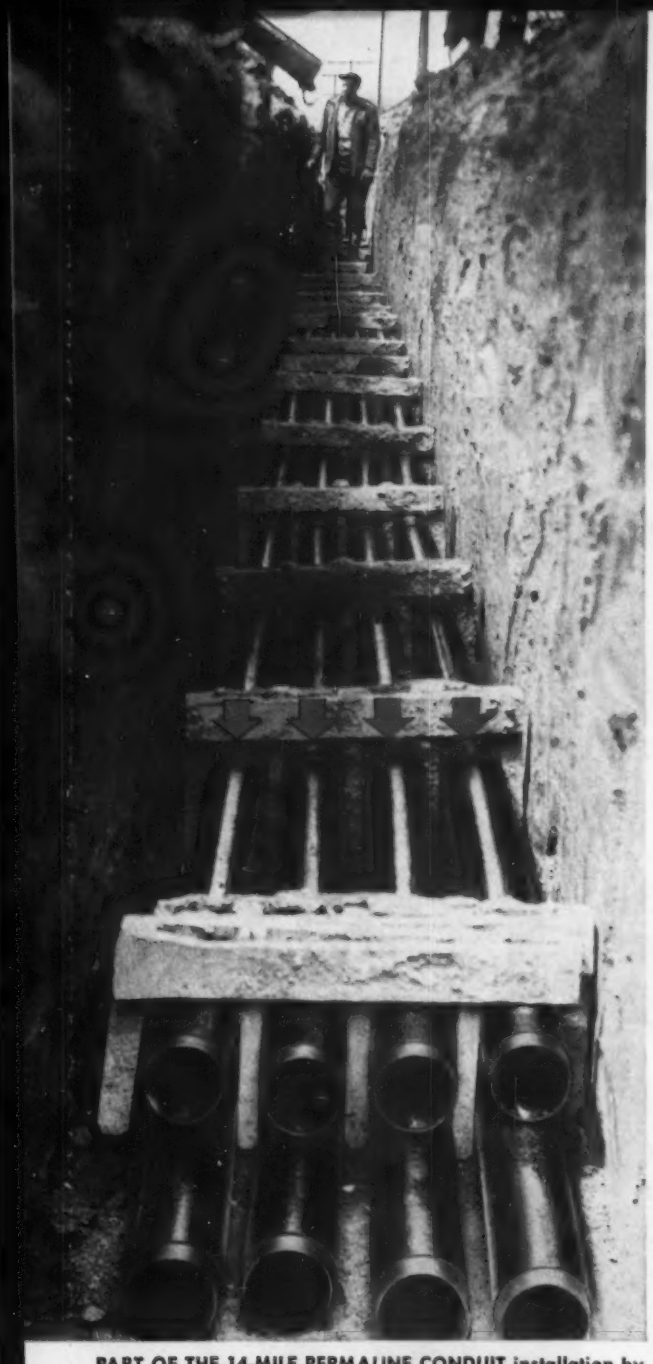
Sticking and caking of coal during combustion will not occur if the coal is sufficiently pretreated with oxygen. Inorganic additive may also be effective in controlling the plastic and swelling properties of coal.

Supervisory circuits for tripping auxiliary relays, valve trip solenoids, and the like should be considered for insuring that the various tripping circuits are electrically continuous and free from short circuits. A method which permits quick occasional supervision is probably best because it eliminates the possibility of sneak circuits with permanent lamp supervisory circuits.

FROM EDITORS IN THE FIELD

The cost to remotely and automatically control a 100-Mw gas turbine plant is estimated to be about $2.50 per kw, according to the British Columbia Electric Co.

Automatic data recorder will help maintain an inventory of fuel sub-assemblies in the core lattice at Enrico Fermi Atomic Power Plant by recording the movement of fuel handling equipment.



PART OF THE 14-MILE PERMALINE CONDUIT installation by Milwaukee Division of Wisconsin Telephone Company. The section shown is in Racine County. The installation, which carries principally intercity trunk lines, was laid in six- and eight-duct runs, in five-foot trenches, with four feet of cover. The L-M Flush-Fit couplings (arrows), which are the same outside diameter as the conduit, permitted a faster installation, requiring a minimum of concrete. This Permaline installation, made in 1956, has been completely trouble-free.

Two-Year Test Shows L-M Flush-Fit Couplings OK on Fibre Conduit

In the fall of 1956, Wisconsin Telephone Company laid a 14-mile run of L-M Permaline Conduit, consisting of six- and eight-duct runs carrying intercity trunk lines.

Unusual Methods Speed Job

To speed up this installation, the contractors used L-M Flush-Fit couplings. These are tapered couplings with the same outside diameter as the conduit itself. They permit one conduit to be laid directly on top of another, doing away with vertical separation and resulting in considerable savings in concrete.

To maintain horizontal separation, wooden forks were used while the concrete envelope was poured. Upon completion of pouring, the forks were removed and reused.

Get Data on Permaline

Permaline Conduit offers many advantages, such as smooth inner bore, consistent high quality, and the Permaline-engineered conduit system with complete procedure, couplings, bends, bell ends, and all other equipment for a fast, efficient installation. If desired, Permaline Conduit is available on skids, in fork-lift bundles, or in steel-strapped slings.

L-M Permaline is offered in sizes 2″ through 6″, in 5, 8, and 10-foot l-o-n-g lengths that save even more time. The most complete line of sizes and lengths. The most complete stocks—in 76 warehouses throughout the country. The largest number of L-M representatives and fibre products specialists to help you engineer your jobs.

Ask the L-M Field Engineer or specialist for information on Permaline Conduit and Flush-Fit couplings; or write Line Material Industries, Milwaukee 1, Wisconsin, for a copy of L-M's 12-point plan folder and Bulletin UG1A. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

THE L-M FLUSH-FIT tapered coupling is formed of light, strong POLYFLEXON plastic. Outside diameter is the same as that of the conduit, so there is no bulge or extra thickness at the joints. On request, L-M Permaline Conduit is shipped with an L-M Flush-Fit coupling attached at one end of each length—without extra charge.

LINE MATERIAL® Industries

McGRAW-EDISON COMPANY

McGRAW EDISON

Permaline Fibre Conduit

378

DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
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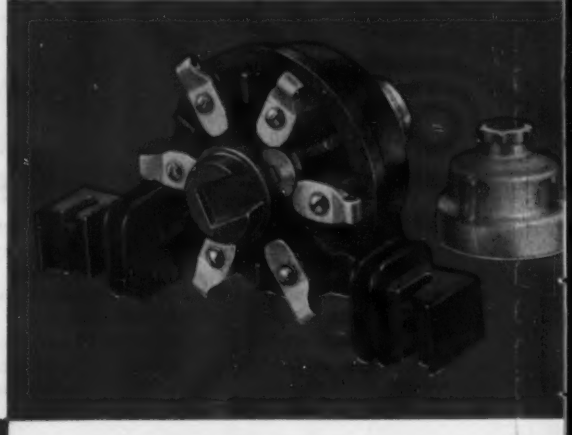
Eliminate costly, time-wasting, dangerous steps

with the externally-

RT & E TAP

The industry—famous RT & E Tap Changer has been redesigned, and repositioned on the tank, for even greater ease in tap setting, speed and convenience in changing tap positions.



FAST 1-2 ACTION

STEP 1
Remove screw-on type cap. Note husky, hand-size gripping area.

STEP 2
Reverse cap and use as handle. That's all there is to it!

The new RT & E tap changer body is molded in one piece, multi-skirted for long creepage and high surge strength. Material used is electrical grade, wood-flour filled phenolic of high thermal stability. Contact is made through a bridging roller, under spring pressure, especially grooved around the periphery to provide double contact surfaces. This assures low resistance and cool operation.

taps

Do it faster, safer, more economically

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CHANGER

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Engineering Talent
Concentrated on One Idea—
A Better Transformer!

RT&E CORPORATION

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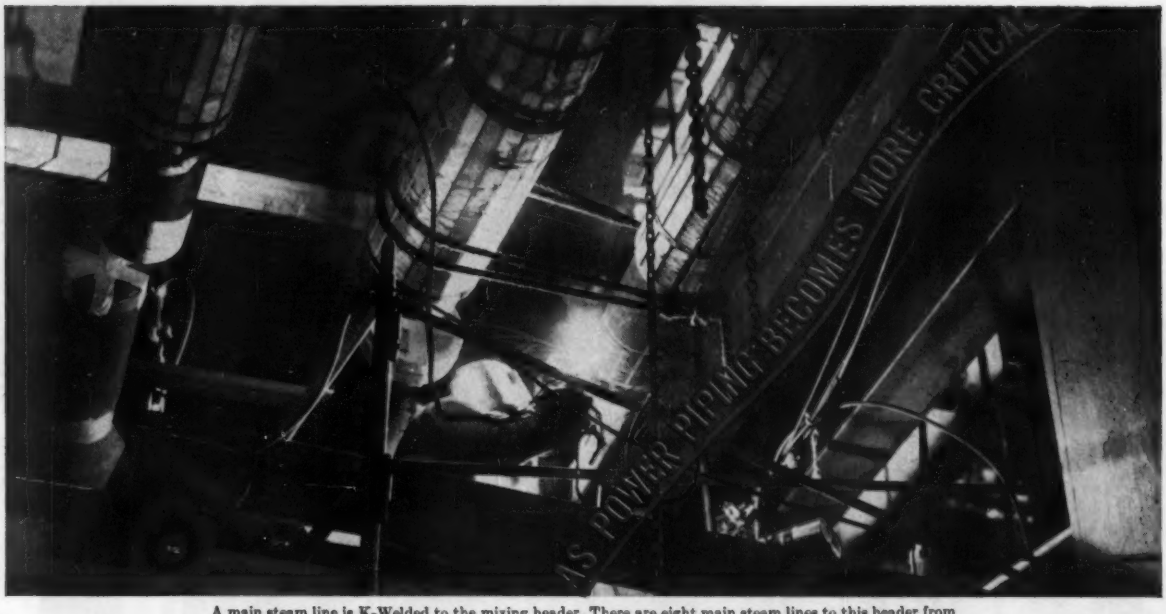
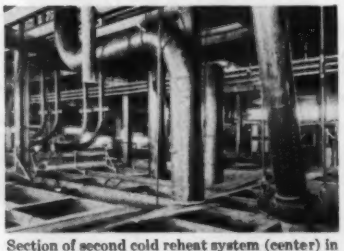


A main steam line is K-Welded to the mixing header. There are eight main steam lines to this header from the boiler, and four from mixing header to turbine. With inside diameters up to 4.938 in. and minimum wall thicknesses as much as 2.860 in., sections weigh four to five tons. Main steam header weighs over ten tons.

KELLOGG'S FIELD WELDING KEEPS PACE



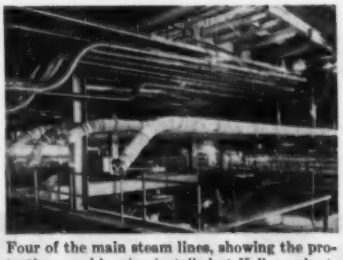
Section of second cold reheat system (center) in process of being positioned, with section of first cold reheat system (right) partially in place. Four boiler feed risers at left.

General view inside Eddystone Station, eleven floors high, showing high pressure boiler feed water risers (top and center) as these were being erected by Kellogg.

During erection of Philadelphia Electric Company's Eddystone Station, Unit No. 1, *eighty* K-Welds® . . . Kellogg's inert gas shielded technique of manual arc welding . . . will be made by Kellogg on the Type 316 stainless main steam lines alone. Following Kellogg's shop fabrication procedures on this job, every K-Weld will be given a total of *four* inspections by liquid penetrant and radiography during welding and after heat treatment.

Time required to finish and inspect each weld completely on this supercritical, heavy-walled piping is *eight to ten working days*. Further evidence of the magnitude and complexity of Kellogg's erection and welding assignment is provided by these construction photographs.

Kellogg welcomes inquiries on its complete service to the power piping industry from consulting engineers, engineers of power generating companies, and manufacturers of boilers, turbines, and allied equipment.



Four of the main steam lines, showing the protective wood lagging installed at Kellogg plant. This is not removed, except at welding points, until insulation is applied.

Six of the eight special high pressure valves being installed by Kellogg at the Eddystone Station—Philadelphia Electric Company's new supercritical steam power plant.

Fabricated Products Sales Division, THE M. W. KELLOGG COMPANY, 711 Third Avenue, New York 17, N. Y.

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POWER PIPING—THE VITAL LINK

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Union Electric solves a crowded channel problem

with General Electric Progress Line mobile radio

Expansion plans at Missouri's Union Electric Company called for more radio-equipped trucks. But new trucks could not be handled by the existing radio system.

So Union Electric went to Ultra High Frequency for its new base stations at Alton and St. Charles and chose G-E Progress Line equipment.

For the utmost in reliability, General Electric's Progress Line now offers the widest variety of thermostatically-protected transistor-power mobile radios available, up to and including 100 watts in low band.

General Electric uses pre-tested communication-type tubes for longer service life . . . controlled reluctance microphones for the clearest possible voice fidelity. What's more, Progress Line equipment is completely interchangeable—chassis for chassis, even between mobiles and base stations—to speed servicing and reduce downtime.

The G-E communications consultant in your area can help you plan an efficient, low-cost radio system. Give him a call. He's listed under "Radio Communication Equipment" in the Yellow Pages. Or write General Electric Company, Communication Products Dept., 9128-1, Mountain View Rd., Lynchburg, Va.

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GENERAL ELECTRIC

For multiple circuit street lighting...

THESE 9 ADVANTAGES MAKE KW ALUMINUM CABLE YOUR BEST BUY!

- Lighter weight than copper for equivalent current-carrying capacity
- Light weight simplifies installation handling
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- Easy to bend, form, train and cut
- Simple to splice, tap and terminate
- Lower overall cost per foot
- Excellent resistance to weathering
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- Backed by 68 years of cable and insulation know-how

To offer utilities greater cable values than ever before, KW has brought its pioneering development in aluminum conductors together with the 68 years proved experience of "the masters of insulation" (formerly U. S. Rubber Wire and Cable division).

For multiple-circuit street lighting systems, KW recommends the constructions described at right. And for wire and cable to fill any utility requirement, call on KW specialists through your KW distributor or Kaiser Aluminum Sales Office.

Kaiser Aluminum & Chemical Sales, Inc., *Executive Office,* Kaiser Bldg., Oakland 12, Calif.; *General Sales Office,* Palmolive Bldg., Chicago 11, Ill.

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Power Supply Cables—Aluminum Conductor

Single or multi-conductor cables, stranded aluminum, sizes 4 AWG and larger, up to 15 KV, shielded or non-shielded.

Specification No. 838-S
Hydrosec® insulation—Neoprene jacket.
For wet or dry locations up to 75° C. Type USE, Style RR, up to 600 volts.

Specification No. 831-S, up to 15 KV
Kalzone insulation—Neoprene jacket.
For wet or dry locations up to 90° C.

Pole and Bracket Cables—Aluminum Conductor

For use in circuits where voltage between conductor and ground does not exceed 600 volts. Sizes 8, 10 and 12 AWG, 7 strand aluminum.

Specification No. 819-S
Street lighting cable, Neoprene type,
Figure 8 Ziplite construction.

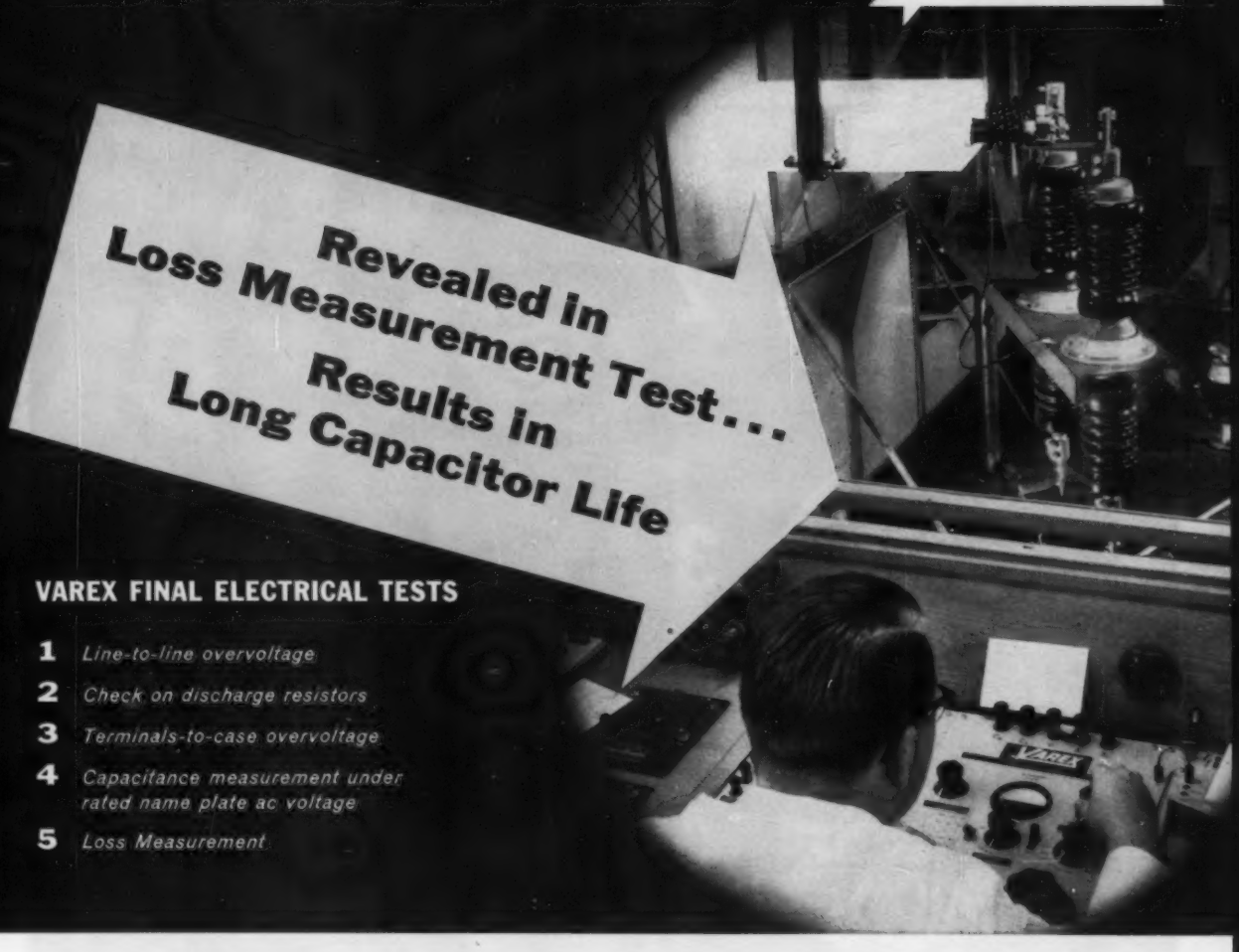
Specification No. 820-S
Performance insulation—weatherproof braid.

Specification No. 838-S
Hydrosec® insulation—Neoprene jacket. Type USE, Style RR.

Specification No. 202-S
Type UF Cable, PVC insulation—PVC jacket.

Specification No. 942-S
Laytex® insulation—Neoprene jacket,
Figure 8 Ziplite construction.

Low Watts Loss in VAREX



The watts-loss per kilovar, as shown on the loss measurement test while the capacitor unit is operating at full 60-cycle voltage, is especially significant to the user when comparing capacitors made with similar materials.

A low watts-loss figure means less heat is generated inside the capacitor. Since life of insulation is affected directly by the insulation temperature, it follows that a capacitor with low watts-loss can have the longest service life.

How does O-B achieve unusually low watts-loss? A major factor is a pumping system that achieves a super-high vacuum at the capacitor outlet (on the order of 15 microns). This super-high vacuum effectively removes moisture from the insulating paper -- one of the principal causes of loss.

Loss measurement is just one of five final electrical tests run on every Varex capacitor. Through these tests you are assured that Varex capacitors will have minimum losses, maximum protection against switching surges and lightning impulses, ability to withstand heat storms and low temperatures, and the ability to deliver the right KVAR output at rated voltage.

OHIO BRASS COMPANY, MANSFIELD, OHIO

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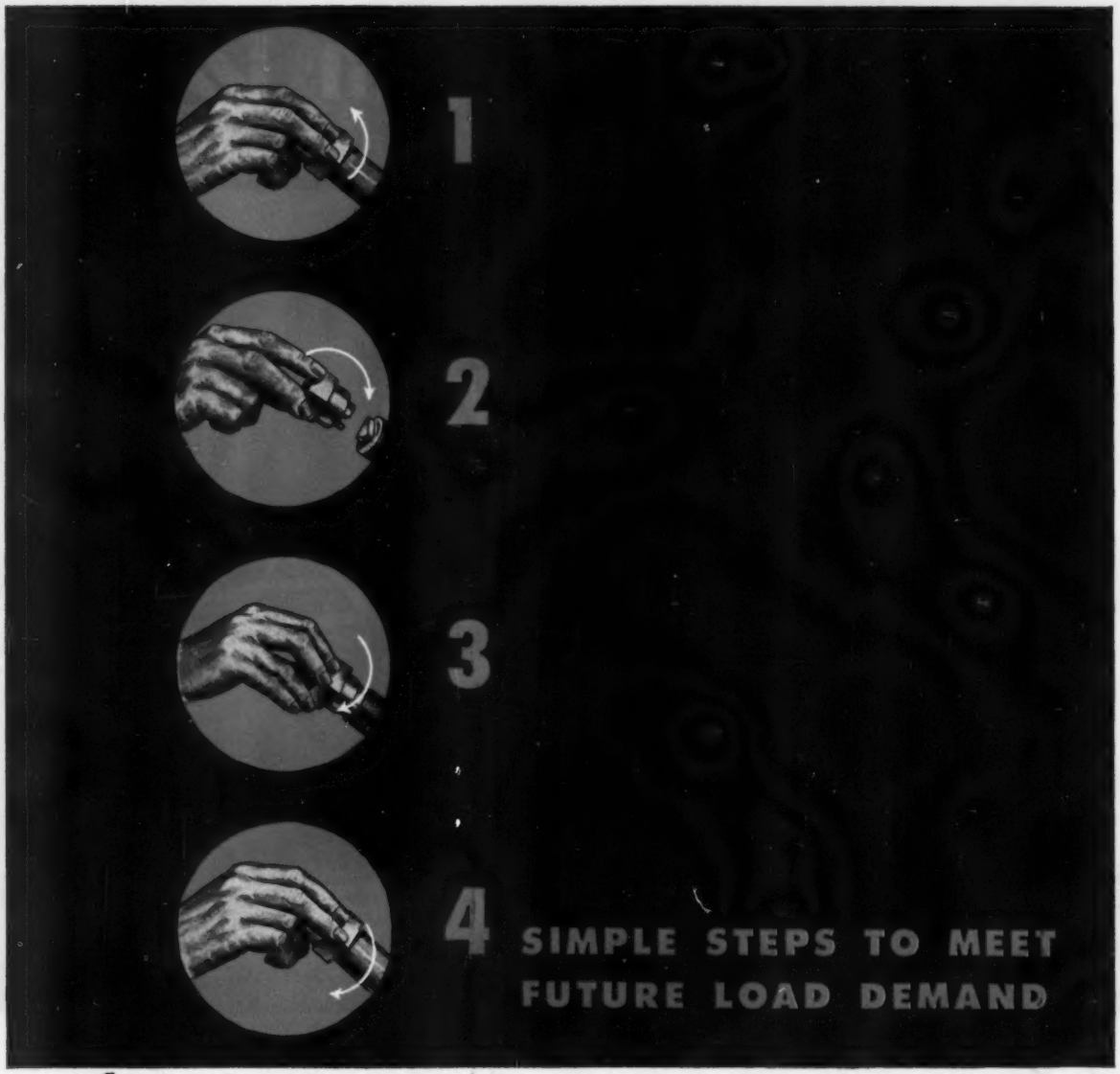

with MOLONEY S-M

To operate simply: 1. Unscrew cap. 2. Turn cap over. 3. Rotate switch to desired switch position which is clearly indicated. 4. Replace cap and screw tight.

Many areas within utility systems will require higher distribution system voltages due to load growth in the foreseeable future. The problem of installing transformers of the proper voltage for today's needs and then later installing transformers with higher voltages is eliminated with Moloney's S-M Distribution Transformers. Moloney S-M Distribution Transformers are easily switched from one voltage to another by means of the externally operated series-multiple switch. ME 58-31

VOLTAGE RATINGS—2400/4160Y x 7200/12470, 4800/8320Y x 14400/24940 Grd.Y, 7200/12470 x 14400/24940 Grd.Y

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FACTORIES AT ST. LOUIS 20, MO., AND TORONTO, ONT., CANADA

Editorial Comment

DECEMBER 1, 1958

Still Needed: A Decision on Higher Service Voltage

We return once more to the matter of higher secondary voltages for residential service. There are growing indications that the industry is growing restive under the delay in reaching agreement on a new standard voltage that can be used in high-use homes.

The promotion of electric house heating and year-round air conditioning is mounting, but so too is the promotion of gas heating. Yet today the matter of service voltage, a key point in the economics of serving this vital and highly-competitive load, remains unresolved.

Electric utilities should act now to remove the barriers that stand in the way of agreement on a standard for higher secondary voltage. The entire industry is looking forward anxiously to the report of the committee that took over the study of this subject over two years ago. When it has been made public another milestone will have been passed and the industry can turn to the matter of establishing the codes and practices that will make needed higher service voltages a practical reality.

But first we need the committee report.

Will It Be Gas or Electricity

During the next ten years the gas industry expects to add over nine million new customers and about thirteen million new space heating, or heating and cooling customers. It expects to get at least four million space heating customers due to conversion, besides the nine million new customers who would have to use gas in order for the goal to be reached.

Now if the gas industry should get the thirteen million space heating customers there will be only four million straight electric customers left. However, our calculations show that in order for the residential sales to increase as now predicted, we will need five million space heating and cooling customers. The industry would have to get these customers from the four million straight electric homes and conversion of existing homes.

If we look at both the gas and our electrical industry predictions, it is obvious that one of us is going to miss by a few million customers. It would be easy to say that the electrical industry cannot possibly get five million heating and cooling customers in the next ten years. That would mean an average of five hundred thousand per year or 40% of the new homes. It looks rather ridiculous when one glances at the past, but it can be done if the industry has the will to do it.

Five million heating and cooling customers in the next ten years would still be 40% of the gas industry's projections for their industry. It is an entirely feasible goal. We can build up from the present rate of thirty thousand this year to eight hundred thousand in 1968. That is entirely feasible.

If there are any doubters regarding the ability of the industry to reach this goal, let them maintain silence. We have enough with vision who will push forward to the five million goal.

Power Paces Boom

Rapid growth of electric utility industry has been a key factor in industrial gains that now challenge Britain's position as the West's second-ranking industrial power

MORRIE HELITZER, Chief, McGraw-Hill's Bonn News Bureau

OLD PUMPED-STORAGE plant, 132-Mw Koepchenwerk Works, was built in '29. All hydro will be utilized by '75

FIRST SUPERCRITICAL PLANT went into service last year. Chemical firm owns the 85-Mw facility, plans another unit

Good planning, an advanced technology, a rich domestic source of coal and water, and the spur of industrial expansion have combined to give West Germany a modern, capable power supply industry.

Thirteen years after the war she has moved into a challenging position to oust Britain as the West's second industrial power after the U. S. The move is accompanied, first, by an increasing shift from mechanical to electrical engineering fields to provide the sinews of industry, and, secondly, by awakened consumer demand for appliances and electrification.

Total installed capacity in West Germany at the end of 1957 was 21,345 Mw, representing a 50% increase in five years, a 133% increase in a ten-year span. By the end of 1958, the Federal Economics Ministry estimates, it will increase another 2,000 Mw.

In a speech last September, Economics Minister Ludwig Erhard said durable consumer goods in German households, such as electric refrigerators, washing machines, vacuum cleaners, radio and TV sets, had increased by 300-400% in the last three to four years. He stressed the even larger potential by pointing out that in every 100 West German families there are presently only seven TV sets, 16 refrigerators, ten electric washing machines, 28 electric stoves, 84 radios and 93 irons. Annual electrical consumption in the Federal Republic doubled between 1948 and 1952 and now, at about 90-billion kwhr, is triple what it was ten years ago.

I. Capital Market Rebound

The domestic capital market, which has been a weak spot in the overall German economic structure, has shown marked improvement in the last few months. Industrial bonds, including those of electric utilities, have received enthusiastic public reception at interest rates which have dropped from 8½% and 9% at the beginning of 1956 to 6% late this year. Result is a basis for outside capital investment in all phases of the electrical power field, whereas previously the bulk of funds came from the companies themselves or from their banks at high interest rates.

Still there are problems of how best to channel investment in order to deal with an expected shortage of 40 to 45-million tons of hard coal units by 1965: whether through increased emphasis on atomic energy, greater brown coal exploitation, or by imports.

II. Amity on Ownership

The debates of public vs private power have largely been missing from the German scene. The public

in West Germany

utilities, which are organized as joint stock companies, own nearly two-thirds of the generating capacity, with the remaining third in the hands of industry. About 1% of total is provided and utilized by the federal railways. Ownership of public utilities is spread between federal and state governments, municipalities, industries, banks and private shareholders.

The public utilities, about 4,000 in all, had 115,000 persons on the payroll in 1957, an increase of 3,000 from 1956. The nine largest of these, supplying about 70% of the nation's public network production, are joined in the Deutsche Verbundgesellschaft in Heidelberg. Without exception in the past five years, they have repeated or bettered dividend payments to stockholders each year. Rheinisch-Westfaelisches Elektrizitaetswerk Ag., biggest of the lot, has paid a 10% dividend for the past three years.

Big utilities maintain information and display offices to encourage purchases and use of appliances. However, they do no direct selling.

Power stations owned by industrial firms provide about 15% of the network supply. But industry as a whole depends on the public net for three-fifths of its needs, supplying the remaining two-fifths from its own installations. Industry consumes about 70% of available kwhr production.

III. The Swing to Big Block Units

While brown coal is increasingly favored where available as a cheap fuel, three of every four kw of installed thermal capacity is presently fired by bituminous. Hydro and other energy accounted for less than one-fifth of capacity at the end of 1957.

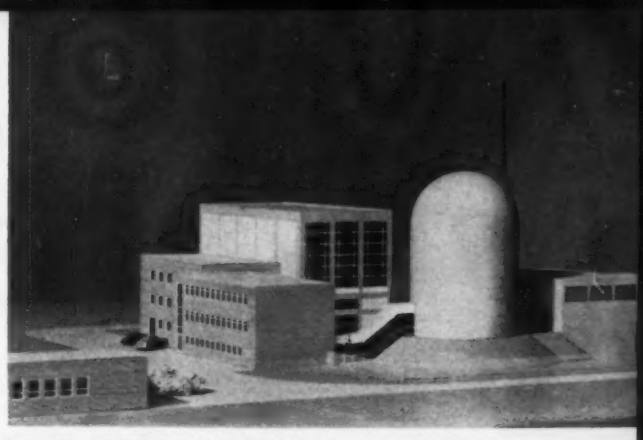
The trend in Germany as in other countries favors large block units in excess of 100 Mw. For the public net in 1950 only 43% of total installed capacity came from 100-Mw units. By the end of 1957, the percentage had risen to over 70%.

Construction for both the public net and for direct industrial use involves 4,000 Mw of bituminous and 1,400-Mw brown-coal fired capacity, most of which will be in large block units.

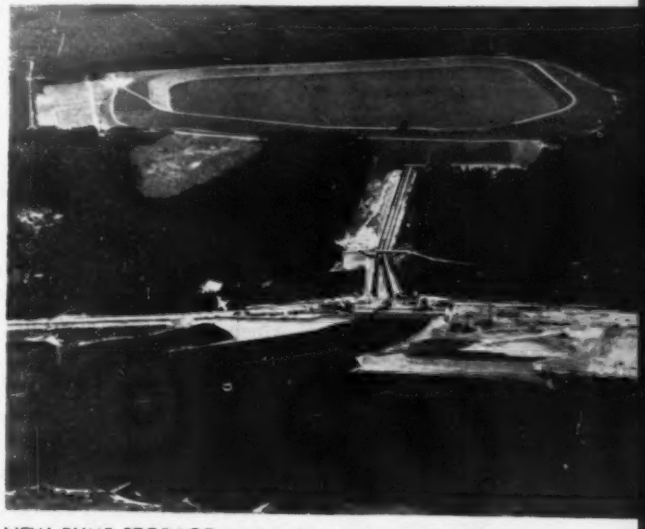
Largest soft-coal fired plant now operating is owned by Gross Kraftwerk Mannheim AG., consisting of a 300-Mw block and several smaller units. A completely new 500-Mw bituminous-coal block at Kraftwerke Wedel near the North Sea, comprised of four 125-Mw units, will be put on stream by Hamburg Electrizitaets Werke AG. in 1960-61. The plant will be convertible to oil, a comparatively new innovation in coal-minded Germany.

During 1957, Rheinisch-Westfaelische-Elektrizitaetswerke (RWE) in Essen added a 300-Mw brown-coal plant at Frimmersdorf to a previously established 200-Mw unit. RWE also has a 350-Mw power plant at Weissweiler. Last December, Rheinpreussen AG. placed the first 100-Mw block devoted principally for industrial use on stream.

The 85-Mw plant operated by Chemische Werke Huels was the first supercritical pressure plant outside the U.S. to be brought into operation. This also

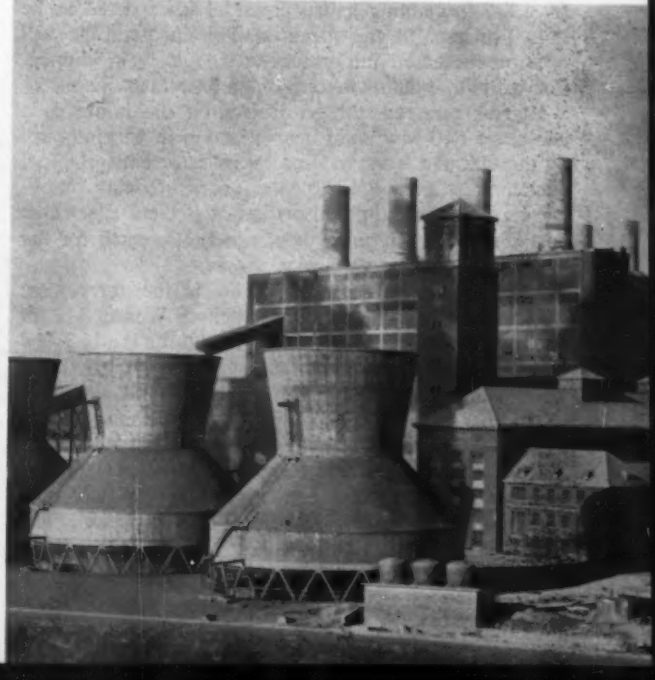


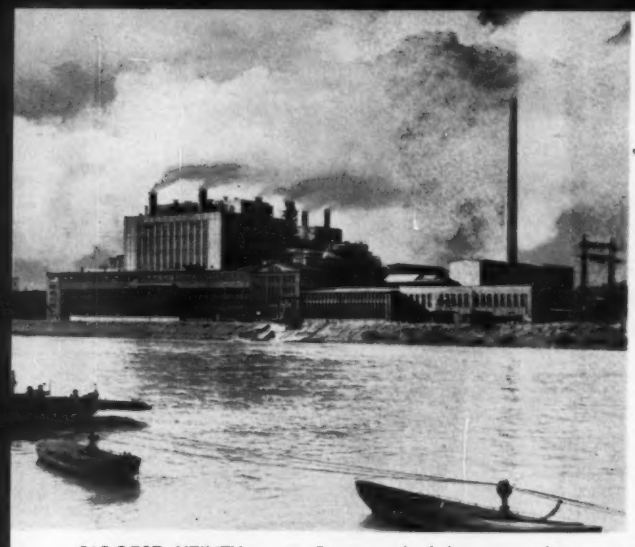
INITIAL ATOM PLANT, a 15-Mw light-water BWR prototype, will be built near Frankfurt/Main to resemble this model



NEW PUMP-STORAGE project hit capacity of 105 Mw in October. It has 265-ft head 1,970 x 1,640-ft storage basin

RECENT 300-MW ADDITION to privately owned Fortuna station ups capacity to 1,000 Mw. Fuel is brown coal





BIGGEST UTILITY owns Frimmersdorf brown-coal station, which will have installed capacity of 1,250 Mw in 1960-61

occurred in 1957 and on the basis of its experience—despite early bugs involving costly repairs—Huels plans a second supercritical pressure block.

A new design feature of German thermal power plants is the so-called smelting funnel fire equipment for burning coal with rich ballast. It allows coal to be burned to within a fraction of 1% of its combustible compounds. Liquid slags which are formed can be extracted more easily than the huge masses of loose incandescent ash formed in most stations. The ash is passed off by being water-flushed into big settling tanks.

Designed to get maximum mileage out of low-grade coal, the funnel has 16 x 16-in. opening so red-hot liquid slag radiates heat back into furnaces. Partly combusted ash is reintroduced to furnace, which attains temperatures of 1,680 to 1,700 deg C, instead of previous 1,000 to 1,280 deg C, causing ash to smelt.

Four-fifths of the hydro plant is in the southern states of Bavaria and Baden-Wuerttemberg. Although only about 50% of total potential has been utilized, hydro generation is playing a relatively decreasing role. By 1975, remaining hydro potential is expected to be fully utilized. In the meantime, pumped-storage will take on increased importance, particularly in connection with atom plants favoring high base-load operation.

Biggest pumped-storage project on the books is a two-stage 640-Mw plant near Vianden in Luxembourg on the German frontier. Largest investor and principal consumer will be RWE. After years of delay in obtaining financing, the consortium of Societé Electrique de l'Our in Luxembourg hopes to break earth for the first 320-Mw stage next year.

Largest pumped-storage station is the three-stage 440-Mw plant operated by Schluchsee Werke AG. in Freiburg. Newest pumped-storage addition is a 105-Mw plant belonging to Hamburg Electrizitaets-Werke, which started putting energy into the net last year.

Another water project is the French-German canalization of the Mosel River between the border city of Trier and Koblenz, where Rhine and Mosel Rivers flow together. It will involve construction by RWE of nine dam steps, each with 18 to 20-Mw capacity. The canalization will make the river passable for barges to ship Ruhr coal to Lorraine and return with iron ore.

IV. EHV—The Proudest Jewel

Proudest jewel in West Germany's system is the 400-kv grid, which started operating over a 214-mi span in October, 1957. The new EHV carries 600 Mw, or 40% of the 1,500 Mw which is almost continuously transmitted in the fall and winter from northwest to south Germany to supplement local power production. Besides looping around West Germany, the grid will dip into Austria and to Luxembourg to tie into the pumped-storage project at Vianden.

The Germans had a 400-kv system with a maximum operating voltage of 440 kv under development before 1945. An agreement in the International Electrotechnical Commission in 1954 specifying a 420-kv maximum led the Germans to select a nominal voltage of 380 kv with a swing of 360 to 420 kv in operation (EW, May 26, 1958, p 56).

Original intention was a double 220-kv circuit that would be converted to a single 400-kv circuit. Dr Georg V. Boll, chief engineer, Technical Division of Deutsche Verbundgesellschaft, explained the change in thinking: "The line would cost only about 10% more, it was found, if its transmission towers right from the beginning were capable of carrying two 400-kv circuits. Each circuit could later be changed over from 220 to 400 kv. And two circuits always guarantee a higher degree of security in operation. Furthermore, rights-of-way are scarce . . ."

Cost per mile of the line, fully equipped, is about $90,000. The Langstab insulator, which is almost universally used in Germany for 110 and 220 kv, was selected. It is puncture-proof and can only flash over. Tests resulted in choice of a four-conductor bundle of steel reinforced aluminum cables.

Extension of the 220-kv grid is continuing as well. A twin-circuit span of 188 mi between Mannheim and Oberrhein has been completed, and a line from Hannover in the direction of Hamburg is under construction. Distribution is also being strengthened by superimposing 220 kv on 110-kv lines and 110 kv on 20 and 30-kv lines. As of Jan. 1, 1958, in addition to the 214 mi Cologne-Stuttgart 400-kv line, the net listed 160 mi of 300 kv, 4,100 mi of 200 kv and 11,600 mi of 110 kv.

In distribution, West Germany enjoys international distinction through the chief of Bayernwerk AG. in Munich, who is also president of "Union for the Coordination of Production and Transport of Electrical Energy," which has operated now for eight years. A telephone call from a member in Germany, France, Italy, and Benelux countries, Switzerland, or Austria to the office of Leonhard Wolf is enough to provide necessary load-shift within hours over national frontiers. No permits, certificates, or state authorization is needed. Payments are no problem either since international exchange of electricity has been liberalized by the Office of European Economic Cooperation.

V. Ten-Year Rule of Thumb

As a rule of thumb, planners figure on a doubling of energy consumption in ten years, with annual increments decreasing slightly each year. *(Cont'd on page 79)*

51 Co's Join in 11th-Hr Reactor Bid

Only private offer to build gas-cooled plant ordered by Congress comes one day before deadline. Philadelphia Electric Co takes the lead in 40-Mw, $25-million project

Private utilities beat the clock Nov. 21 with an offer to build a $25-million, 40-Mw-capacity gas-cooled reactor for civilian power.

A group of half a hundred utilities joined in presenting the only bid to the Atomic Energy Commission. They made their offer one day inside the Nov. 22 deadline set by AEC for bids on the project, which Congress has ordered to be built—if not by private enterprise, then by the government.

Group Teamed with Philadelphia

The utilities formed a new group, The High Temperature Reactor Development Associates, Inc, to make the bid, together with the Philadelphia Electric Co.

Now, the AEC will make its decision as to whether the offer is satisfactory. Chances are, Chmn. McCone and the other members will grab it up.

The commission on Sept. 22 invited industry to propose plans for a high temperature, gas-cooled (helium) nuclear power plant.

The prototype plant the utility companies propose to build is the high temperature, gas-cooled (helium), graphite-moderated reactor system conceived by General Atomic Div of General Dynamics Corp. General Atomic's laboratory has been researching the project over the past two years.

Philadelphia Electric Co was sponsor of the project proposed to the AEC.

The new group is the largest group of U. S. utility companies to support a single nuclear power project.

R. G. Rincliffe, president of Philadelphia Electric, on whose utility system the proposed prototype plant will be built and operated, made the proposal to AEC. Philadelphia Electric will own the plant. The actual site for the plant, which is scheduled to be completed late in 1962 or early in 1963, will be announced soon.

The proposal calls for development, design, construction and operation of a plant of 40-Mw capacity. In its initial operating and testing phase, using its first nuclear core, the plant will have a capacity of about 30 Mw.

Bechtel Corp will be the engineer-constructor.

General Atomic will be responsible for the nuclear portion of the plant.

Westinghouse Electric Corp will be responsible for the plant's electric generating system, including the turbine and associated equipment.

Construction cost of the plant will be $24.5 million under a fixed price contract by Philadelphia Electric and the other utility companies with Bechtel Corp. The government is asked to assist on research and development costs.

AEC Would Pay $14.5 Million

The offer depends upon the AEC agreeing to contribute to further research and development costs, both pre- and post-construction.

General Atomic proposed, under a cost-price contract with the commission, to fix a ceiling of $14.5 million on the research and development costs contributed by AEC.

The cost of building the developmental prototype will be borne by Philadelphia Electric and the other utility companies. No financing arrangements have yet been specified.

The plan offered to AEC emphasizes the project has these favorable factors:

- Use of inexpensive construction materials with a resultant lowering of costs, particularly in large-size plants.
- High steam pressures and tem-

Participants in New Group Represent All Sections of United States

Alabama Power
Arizona Public Service
Atlantic City Electric
Baltimore Gas & Electric
California Electric Power
Central Illinois Gas & Electric
Central Illinois Light
Central Illinois Public Service
Central & South West Corp
  Central Power & Light
  Public Service of Oklahoma
  Southwestern Electric Power
  West Texas Utilities
Central Louisiana Electric
Cincinnati Gas & Electric
Cleveland Electric Illuminating
Delaware Power & Light
Detroit Edison
Gulf Power
Gulf State Utilities
Hawaiian Electric Ltd
Idaho Power
Illinois Power
Iowa Public Service
Kansas City Power & Light
Kansas Power & Light
Kentucky Utilities
Middle South Utilities
  Arkansas Power & Light
  Louisiana Power & Light
  Mississippi Power & Light
  New Orleans Public Service
Mississippi Power
Missouri Public Service
Montana Power
New York State Electric & Gas
Niagara Mohawk Power
Pacific Gas & Electric
Pacific Power & Light
Pennsylvania Power & Light
Philadelphia Electric
Portland General Electric
Public Service Electric & Gas
Public Service of Colorado
Public Service of New Mexico
Puget Sound Power & Light
Rochester Gas & Electric
St. Joseph Light & Power
San Diego Gas & Electric
Sierra Pacific Power
Southern California Edison
Utah Power & Light
Washington Water Power

peratures, resulting in high thermodynamic efficiency and permitting the use of the most modern steam turbine equipment.

• Low fuel-cycle cost arising from a high degree of burnup of the nuclear fuel.

• Good nuclear economy.

"For nuclear power to succeed in competition with conventional power sources, which normally use fossil fuels," Rincliffe said, "we must set about developing nuclear plants designed to conform to modern-day steam conditions, in terms of working temperatures and pressures. That is what we now propose to do.

Reactor Type Holds Promise

"The high temperature, gas-cooled, graphite-moderated reactor system and particularly its homogeneous fuel elements, appears to give great promise of meeting the basic requirements for a truly major advance in reactor technology and economics."

The 85th Congress had called for development and construction of a high temperature, gas-cooled, graphite-moderated power reactor. The 1958 legislation established a deadline for inviting proposals from industry. In lieu of an acceptable proposal from industry within 60 days after the AEC's invitation, the commission was directed by Congress to build and operate such a plant at one of its installations.

The AEC invitation specified the development, design, construction and operation in the U. S. of a reactor "of sufficient size to serve as an effective prototype for a future full-scale plant." It suggested a prototype plant of about 30 to 60 Mw, and specified that the exit temperature of the coolant gas must be at least 1,000 F.

The plant is designed to produce the 40 Mw from steam at 1,000 F and 1,450 psi, using the graphite-canned fuel elements. With its initial loading of metallic-clad fuel elements, the plant will produce about 30 Mw of power from steam at 850 F and 850 psi.

While the General Atomic high-temperature, gas-cooled, graphite-moderated reactor system is expected to get economic nuclear power, the prototype plant won't meet that objective. Nevertheless, a major step will be taken by reason of the program and prototype.

Indemnity Loopholes Hit

Several electric utilities are disturbed over the failure of the AEC's indemnity program to protect them against claims arising out of possible accidents occurring while their fuel elements are being transported.

As a result, they want terms of available insurance policies revised before they are officially accepted by AEC as evidence of the financial protection required by the Price-Anderson indemnity law.

Under the law, the government offers reactor licensees indemnity up to $500-million—but to qualify, the licensee must carry all available commercial insurance.

AEC in September invited comments on a proposed form of indemnity agreement to be offered licensees, and on the proposed language of policies to be offered by two insurance syndicates.

Some 20 comments have been received from electric utilities, reactor manufacturers and attorneys. AEC spokesmen hope to digest these, make any necessary revisions and issue a final version by January.

Objections raised by industry centered around two points:

• Neither the proposed indemnity agreement nor the policies cover transportation of radioactive material from the diffusion plant to the fuel processor, and from the processor to the fuel element fabricator.

Since the reactor owner normally will be the licensee of the fuel from the time it leaves the diffusion plant, he may be liable for any injuries or damages while it is in transit—but not be insured or indemnified.

Commonwealth Edison Co notes that it thus would not be protected "against public liability incurred" by Edison in the shipment or processing of radioactive material from the point of delivery of such material at Oak Ridge to Edison's Dresden nuclear plant.

Power Reactor Development Corp makes a similar point with regard to shipments of fuel elements to its reactor site.

• There is an apparent "gap" in coverage where more than one incident occurs at the same reactor site.

The law requires the licensee responsible for maintaining financial protection to the amount of coverage available. Yet, under the terms of the proposed policy forms, any claims paid out as the result of a nuclear incident reduce by that amount the remaining value of the policy.

There is no automatic reinstatement. If the licensee were to suffer a second accident before getting the full value of the policy reinstated, he might not be fully covered.

U.S. Power Picture

- **Bleak picture painted of air pollution problems**
- **Round 2 of OH line fight won by CEI; appeal slated**
- **Tampa Electric's 20-yr coal contract ruled invalid**

"The finger of suspicion always points to the fella with the highest smoke stack."

This cryptic note of warning was sounded last week by a power company vice president following the widely publicized mid-November National Conference on Air Pollution in Washington.

The "stack-height guilt" dangers were fueled as a bleak picture of the nation's air supply was painted by spokesman after spokesman. The 900 industry and government representatives were told, for example, that each day automobiles and trucks dump over 100 tons of pollutants in Seattle's air. And, it is about the same in other cities of comparable size.

Over 20 tons of contaminants are discharged daily per 100,000 persons where oil heating is used in the home. If coal is used, the figure jumps to over 100 tons a day. Medical experts talked about a probable relationship between air pollution and lung cancer and respiratory ailments.

Industry took its turn on the plat-

form and explained the millions of dollars it already spends annually in controlling air pollution. The reaction, however, indicated that present control measures are not enough.

Industry had a patent example of just how far a community will go with controls. Los Angeles—undoubtedly the hardest hit area by air pollution—recently slapped an order on all industry in the critical smog area that makes it mandatory to use natural gas instead of fuel oil for industrial combustion during periods of intense air pollution. There is already a ban preventing home owners from burning trash.

And, Los Angeles is currently working on a new zoning plan that will force certain types of industry—mainly petroleum and chemical—to move out beyond the critical air pollution area.

There was no question about the real concern of the conference delegates over the health and other harmful effects of air pollution. But, surging below the surface was another concern of industry: Don't panic the public into getting a batch of air pollution control regulations adopted that will cripple industry where less severe controls may be adequate.

What industry drove hard to impress on its government counterparts is that close liaison—including a sharing of the cost—should be established between industry and government to work jointly on the problem. Additionally, there were over 50 other specific recommendations made as a starting point toward cleaning up the air. Primarily these called for more research and studies into all aspects of the matter.

• The city of Euclid, suburb of Cleveland, will seek an Ohio Supreme Court ruling on its fight to force the Cleveland Electric Illuminating Co to install underground rather than overhead lines through the city.

This was indicated by Euclid Law Director Paul H. Torbet after the Court of Appeals ordered the city to issue permits to the CEI for the overhead installation of 132-kv lines. The Appellate Court decision upheld the recommendations of Prof Clinton De Witt of the Western Reserve Law School, who sat as special master in the bitterly contested case.

In a 104-page report issued in July, De Witt found that Euclid's ordinances requiring that the lines be buried were unduly oppressive and that the proposed underground lines would cost the company $3.5 million more than the overhead.

Torbet said: "this is a fundamental problem in the home rule power of municipalities. Many lawyers have urged me to take the case to the U. S. Supreme Court.

"Since the CEI placed a lot of weight on arguments that automatic relays cut off power when these wires break and render them harmless, I plan to propose an ordinance requiring that every single overhead wire in Euclid carry such relays no matter what its voltage. If they are so good, their use should be more widespread to protect lives."

• A Nashville federal court has ruled that a 20-year contract between Tampa Electric Co and three Nashville coal companies is invalid.

The decision will be appealed, said W. C. MacInnes, Tampa Electric president, who added that the ruling has far reaching implications.

The power company in 1955 contracted with Potter Towing Co to supply all the coal required to generate power at Gannon Station. Subsequently, Potter Towing was taken over by Nashville Coal Co, a subsidiary of West Kentucky Coal Co. The parent firm later declared the contract invalid and announced it would not fulfill it. Tampa Electric sued and on Nov. 18 the federal court ruled in favor of the coal company.

The coal firm had argued that the contract violated the Clayton Anti-Trust Act and would tend to freeze out competition, since it was exclusive and applied to all of Tampa Electric's future developments. The power company had sought a declaratory judgment that the contract was enforceable.

MacInnes told Electrical World that "I have already heard rumblings from other quarters. Other coal and gas companies are concerned about their contractural relationships." He pointed out that two utilities—Florida Power & Light Co and Florida Power Corp—who recently contracted for fuel from a natural gas line of Houston Gas & Oil Co, were compelled by the FPC to sign for 20 years.

• Dixon-Yates group has filed a revised $1,885,687 claim in the U. S. Court of Claims against the federal government for damages following cancellation of its contract to supply power to AEC.

The claim is in line with a court commissioner's September report, which estimated that the government's total lability in the claim could not exceed $1.8 million: $430,000 for legal fees; the rest to cover expenses such as contract obligations to construction and engineering firms.

The government probably will file its brief, denying any liability, before the end of 1958, and the court is expected to hear final arguments in March or April.

Dixon-Yates filed a claim for $3,534,778 in 1956, but salvage value of some of the equipment involved reduced the size of the claim.

International Currents

(From McGraw-Hill World News Bureaus)

The Soviet shift from hydro to steam plant construction appears to be in full swing. Late last month Tass announced plans for a 2.4-million kw coal-fired plant, "the biggest of its kind in the world."

Although omitting the location of the plant site, the publication contained this description of the proposed facility:

"Much fuel will be consumed to maintain a temperature of 650 deg in the boilers, at a pressure of 300 atmospheres (4,410 psi). Every hour 1,600 tons of coal will be burned.

"The hall housing the machinery will be 250 meters long. The boiler will be almost 50 meters high."

Emphasis on steam generation was underscored by Arkadji Markin, scientific researcher at the Power Institute of the U.S.S R. Academy of Science, in mid-October.

"The current plans call for the construction of over 200 large thermal power stations in different parts of the country," he said.

SEE Engineers Scan System Needs

Engineering and Operating Section discusses merits of higher voltage distribution, compares transmission structure designs and weighs improvements in generation. Real Estate Section shares two day program at Roanoke, Virginia

Twenty years will see many changes in electric utility systems. Higher secondary voltages will be the rule for residential and commercial customers. Residential distribution circuits will be underground. DC transmission using underground cable will begin to appear. Generating units will reach 750 to 1,000 Mva each but their size will decrease due to improved iron, insulation and cooling.

These were among the predictions for the future of the utility industry made by T. P. Jones, Westinghouse Electric Corp at the opening session of the Southeastern Electric Exchange Engineering and Operating Section meeting at Roanoke, Va.

Jones predicted that nuclear plants by 1978 will account for one-fourth of the nation's capacity. About half of the capacity then being installed will be nuclear. Both nuclear and conventional stations will be too large and complex for men to handle. As a consequence computers will take over control of all functions from fuel to kilowatts.

Speaking from the same platform George White, manager of General Electric Co's Atomic Power Equipment Dept. described his company's two-pronged program to put U.S. utilities in the market with competitive atomic power by 1965. The proposal (EW Nov. 10 p 58-59) contemplates two parallel programs. One, "Operation Sunrise" calls for an accelerated test and development leading to perfection of large scale boiling water reactor power plants capable of producing energy for 8½ mills by 1965. Such "evolutionary plants" would be the outgrowth of possibly five developmental BWR plants of 25 to 100 Mw capacity to be designed and under construction by 1962. Second phase of the program "Operation Know How" contemplates accelerated field installation of up to 50 packaged 5-Mw BWR plants to provide needed experience and training in operation of atomic stations, White said.

The most important single technique for cutting costs and increasing production is effective communications, R. J. Cooper, Georgia Power Co, told the SEE engineers. Good channels of information, Cooper said, provide a means of reviewing accomplishments by passing out credit for good work and pointing out why cost for a particular job are too high.

Higher Voltage Favored

Speaking at the distribution session, E. M. Geddie, Carolina Power & Light Co, said experience since 1945 has proved that 13.2/23 kv distribution gives better and more economical service to customers than lower voltages. The higher voltage presents fewer tree problems because a single clear street can be found more easily for a backbone feeder than several streets required for lower voltages. It is safer too, because only one primary circuit is carried on top of the pole, and this is worked with hot sticks.

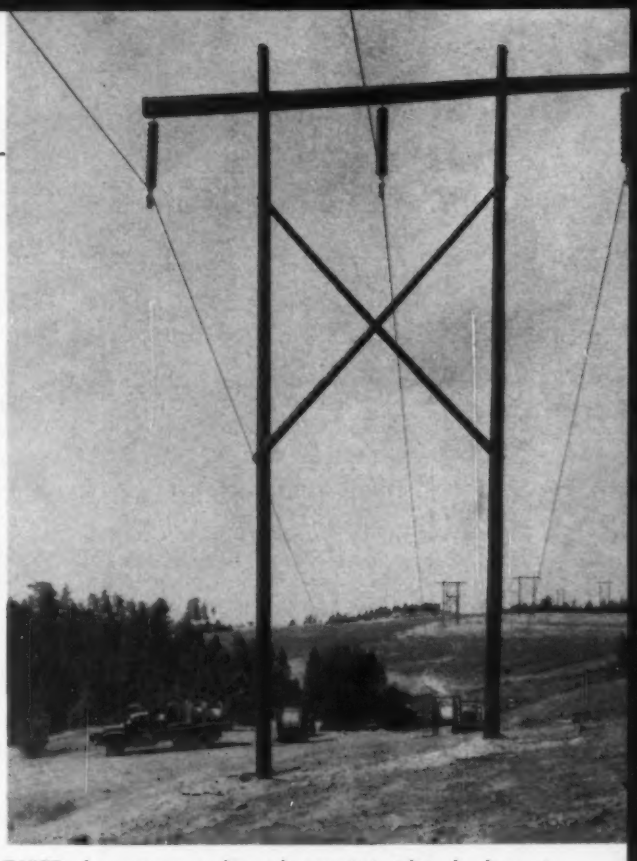
Electric utilities should act to eliminate barriers in the way of high secondary voltages, P. D. Huff, Duke Power Co said. Situations already exist where a utility can conveniently offer higher utilization voltage; but appliance, equipment, wiring code and other practices in the electrical industry are not adjusted for it. Utilities need to meet with manufacturers and code representatives to eliminate these obstacles, Huff said. He urged other companies to consider furnishing service risers as a promotional features for residents with 100 amp or larger

(Continued on page 78)

RIGHT-OF-WAY MODEL used by Florida P&L in real estate negotiations is explained by T. E. Carter, pointing, to C. C. Calloway, Eastern Shore Public Service; H. L. Berly, Gulf States Utilities Co; George Marse, Louisiana P&L, and R. L. Bortner, Potomac Electric Power

Woodpole Arms and Braces Reduce 230-Kv H-Frame Line Cost

Washington Water Power builds 106-mile through farmland for about $26,000 per mile; and other savings were also obtained



TAPER of crossarms and crossbraces is just barely discernible. Wood poles for verticals, crossarms, crossbraces helped keep line construction costs at about $26,000 per mile

EARL BAUGHN, Transmission & Distribution Engineer (retired), Washington Water Power Co, Spokane, Wash.

A reliable, low-cost, 106-mile 230-kv transmission line, having woodpoles for verticals, crossarms and crossbraces, was recently placed in service by Washington Water Power Co. This Spokane-Lewiston line was built in nine months for about $26,000 per-mile, of which $4,800 per mile represented the cost of right-of-way procurement and clearing.

Use of woodpole crossarms and crossbraces saved about half the material cost of spar arms and square-sawed crossbraces with hardware without sacrificing reliability or ease of maintenance. An additional significant saving was achieved by using all-aluminum conductor. Cost savings in material incurred no increased labor outlay.

A study made several years ago showed a 230-kv line was needed to carry the 1957-58 peak demand of the Lewiston area, served from Spokane over two 115-kv circuits. The Lewiston area has been growing at a steady 12% annual rate, compared to Water Power's overall long-term 8%.

Construction, authorized in 1956, was completed in December 1957 at the outset of the peak load season. Upon initial energizing, the line picked up 80 Mw, reversing the flow through the Lewiston portions of the 115-kv lines to a null point near their center and reducing losses by a calculated 7.5 Mw.

Line Traverses Farms

The line stretches from Beacon substation, near Spokane's east city limits, to Lolo substation, southeast of Lewiston. Most right-of-way is through western Idaho's rolling farmlands, where wheat and dried peas are the principal crops.

Highways and improved county roads, available for construction purposes, assisted in keeping costs low. But right-of-way cost was greatly increased because of the type of farmland the line crossed. The roughest country was in the foothills each side of the Spokane Valley at elevations up to 3,900 ft.

Relative merits of ACSR and all-aluminum conductor for this line were checked prior to design. Use of wood instead of steel structures limited maximum conductor tensions which could be applied without exceeding structure strength. Also, it was decided to hold normal tension to a value about 16% of all-aluminum's ultimate to prevent dangerous conductor vibrations without the use of dampeners. As ACSR's additional strength would not be utilized, the considerable first-cost savings through omission of the steel core were obtainable. Use of all-aluminum conductor resulted also in a significant saving in losses at certain loadings.

The all-aluminum conductor chosen is "Narcissus," 61 strands, 1.300-in. dia and 22,000-lb ultimate strength. Design condition is 9,000-lb tension under NESC heavy loading. Resulting normal tension is 3,600 lb at 60F and no load.

Normal span length on level ground, using 70-ft poles and 32-ft ground clearance at 120F, is 630 ft. Maximum span is 2,250 ft, across the Clearwater River near Lewiston.

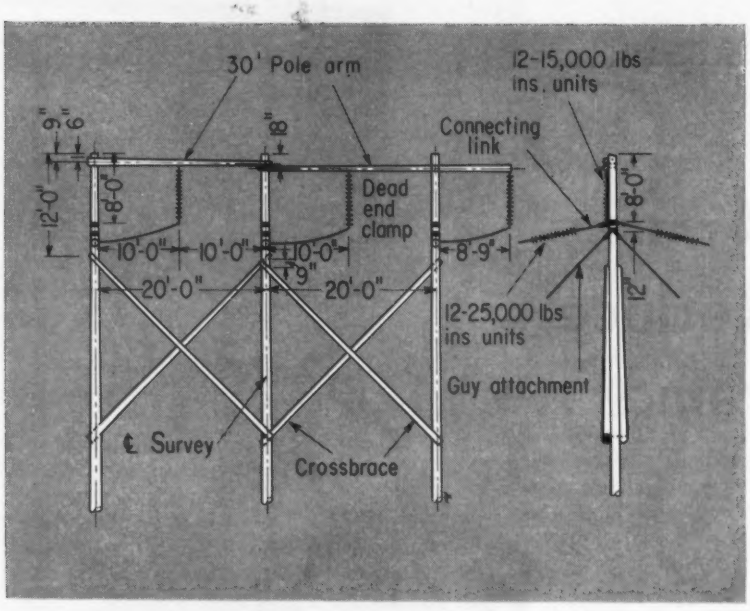


FIG 1—TANGENT STRUCTURE is simple and easily erected by conventional methods. Poles are Western larch, red cedar, Class 1 and Class 2, butt treated

Preformed armor rods are used at all suspension clamps. Deadend clamps are bolted. No vibration dampeners are used. Vibration in longer spans will be checked, and when found excessive, dampeners will be added. It is expected, however, that the light normal tension will prevent dangerous vibration.

A few combination suspension-clamp and armor-rod assemblies are used on a trial basis.

Shield wires are strung only about 1 mile out of terminals. They and guy cables are $\frac{7}{16}$-in. high-strength galvanized steel. Shield wires are grounded at each structure with four $\frac{5}{8}$-in. by 8-ft copperweld ground rods.

Insulators are standard 10-in. dia 5¾-in. spacing, ball-and-socket type, 12 units per string. Suspension strings consist of 15,000-lb units, and deadends are single strings of 25,000-lb units. Use of only 12 units was predicated on the area's low isokeraunic level and good operating experience on the 230-kv Cabinet Gorge-Spokane line.

Structures are the two-pole "H" type. Poles are Western red cedar or Western larch, Class 1 and 2, butt treated. Larch poles are shaved full length. Lengths are 60 to 90 ft, with 65 to 70 predominant.

Crossarms are 40-ft full-length-treated Western larch poles. The large end is slabbed off to a 11½-in. width to reduce weight. Minimum circumference attachment is 36 in.

Crossbraces are also full-length-treated larch poles, 30-ft long, Class 8.

Standard transmission hardware is used wherever practicable. The few non-standard items include the brace adding support to the crossarm through-bolt, and the yoke and band for connecting insulator strings and guys to the pole.

Hardware is bonded and grounded in the line's unprotected part. Pole ground wire is No. 6 galvanized iron, wrapped around the pole butt for earth connection. Where shield wires are used, hardware is group-bonded but not connected together or grounded.

The $\frac{7}{16}$-in., high-strength galvanized steel guys have 18,000-lb ultimate strength and are attached to a yoke at the pole by preformed guy grips to anchor rods. Anchor rods are ¾ in. by 8 ft, and anchors are 20-in. cross-plate steel.

Survey and mapmaking were entirely by aerial photography. Photographs with about 60% overlap were taken along a route designated on USGS quadrangle maps.

Location of line centerline and angles was designated with the aid of contact prints and a steroscopic viewer, and with planimetric maps. The aerial mapping company prepared the usual 400-ft: 1-in. maps and a profile for placing structures.

The mapping company furnished photographs to the same scale with centerline and structure locations in red for use in purchasing rights-of-way. Earlier, the mapping company's field crew designated structure location by stakes.

Usual woodpole-line construction methods were used. The conductor was tension-strung to prevent touching the ground, thus mitigating damage and dirt pickup which might cause excessive radio interference on first energization.

Wire was sagged with a correction to compensate for an expected long-term creep of the all-aluminum conductor which would increase sag in a 600-ft level span by 2 ft. The increase in sag due to creep is checked in one normal level span.

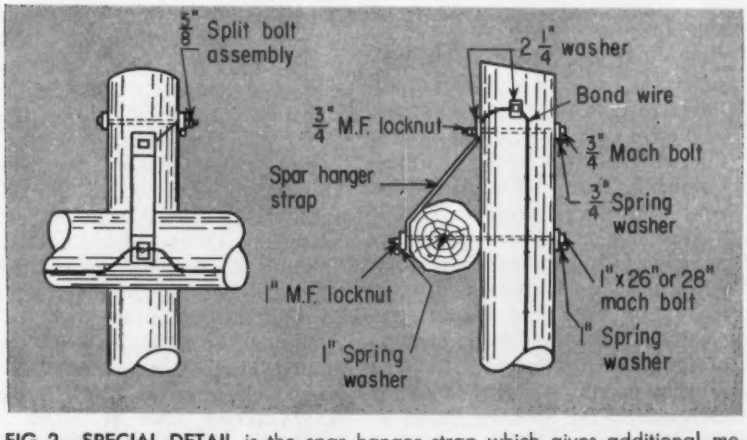
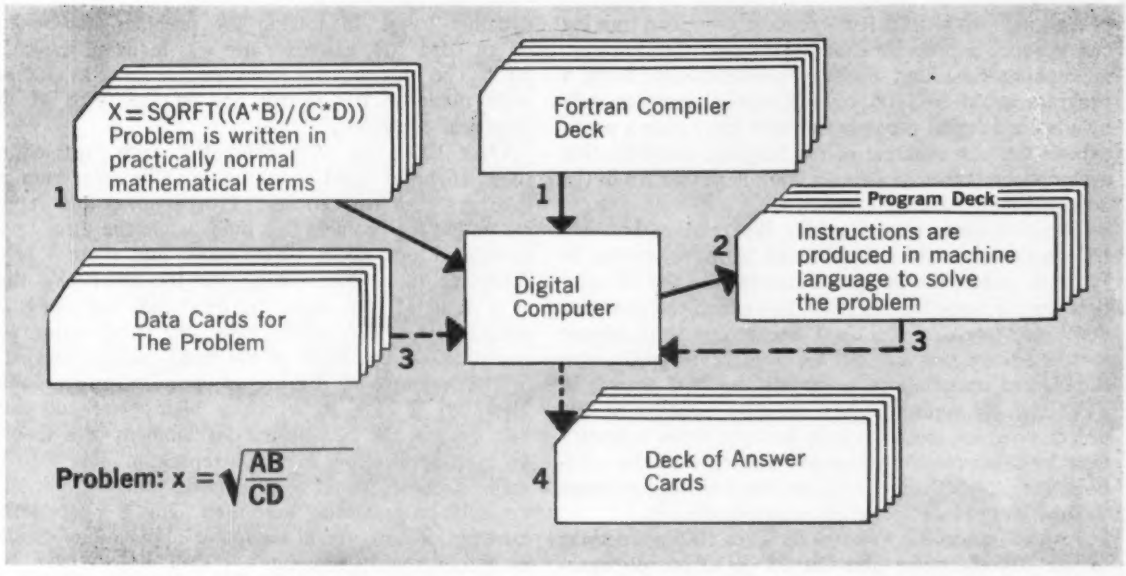


FIG 2—SPECIAL DETAIL is the spar hanger strap which gives additional mechanical support to the crossarm through-bolt. But most hardware was standard



HOW THE FORTRAN COMPILER WORKS: The problem is stated in near algebraic language (1) and fed into the computer along with the compiler. The result is a deck of instructions in machine language (2). These are fed back into the computer along with the problem data (3) from which are developed (4) a deck of cards containing the answers

Compilers Ease Digital Programming

New compiler techniques like Fortran bridge the gap between engineering language and computer language. They cut the time and cost of programming and open the way to economic solution of one-time problems

J. T. CARLETON, Analytical Dept,

C. J. BALDWIN, JR., Electric Utility Engineering Dept, Westinghouse Electric Corp, East Pittsburgh, Pa.

Dramatic developments in digital computer hardware over the last decade provide the equipment necessary to solve many complex engineering problems. Equally important developments in programming techniques make the computer effective in solving a myriad of power system problems. One of the latest developments in programming are compiler programs, which translate the every-day operating language of the engineer into the formidable machine language of the computer.

Compiler programs are significant because they will:

1. Give the power system engineer the ability to optimize his coding and minimize errors that develop from unfamiliarity with computer language.
2. Greatly reduce the machine time, and therefore the cost, necessary in preparing programs for computer solution of engineering problems.
3. Allow utility engineers to make greater use of computer time available on equipment in the utility's accounting department or at computing centers.
4. Open the way to solution of complex problems which are of a non-recurring nature.

Initially, the unavailability of digital computers was the major obstacle to extensive use of digital analysis by power system engineers. But as computers beeame more available, they also grew in complexity and capacity and continued to offer a wide gap between the power engineer and solution of his problems. Filling this gap was the trained digital analyst, usually a mathematician or an engineer expert in numerical analysis, and computer logic and programming.

For successful and economical application of digital analysis, the abilities of both the trained analyst and the engineer—the man with the problem—are essential. But difficulties arise when a trained analyst is not available and the engineer is not computer oriented.

To overcome these difficulties, the engineer with the problem must be taught to think in terms of flow charts or logic diagrams. With problem layout and solution procedure approached through a detailed flow chart, the engineer is more likely to develop the optimum logic for a mechanized solution. Then, with techniques like compiler programming, the engineer has the means to bridge the gap between the engineering language stating the problem and the machine language required for digital solution. This article will explain the compiler program known as Fortran (formula translation), developed by International Business Machines for the 704 digital computer. A similar compiler, For Transit, is available for the IBM 650.

An engineer with a few hours of compiler training can produce a program that is very near the optimum in running time and memory conservation. Such a program could be produced without a compiler only by a trained digital programmer with more than a year's experience. An example of the language simplification accomplished through use of a compiler is shown in the accompanying panel.

The arithmetic statement for the relation between FC and the variables D, L, and A is re-written in Fortran. Below the Fortran statement are the 24 symbolic instructions for the IBM 704 which the compiler developed to calculate FC. They are complete, except for the square root subroutine, from bringing DL into the cleared accumulator to storing the final answer in FC. The subroutine SQRT actually appears in the object program, because it is brought from a library tape by the assembly program working with the symbolic language. Every step from the Fortran statement to the binary object program is automatic.

Instead of needing to know the over 100 instructions of the 704 computer plus the 25 or so psuedo operations accepted by the assembly program, the engineer needs to know only the 32 English-type statements of the compiler. In fact, he can do a great deal of programming with fewer than the 32 statements.

Problems restricted in scope, which normally can be justified for computer study only if repetitive calculations are made, are ideally suited to compiler use. Examples include lightning theory development, travelling wave propagation, circuit breaker recovery voltage, and distribution system voltage planning.

To compare results of the "prestrike" theory of the lightning stroke with published current-time characteristics of laboratory gap flashover tests, it was necessary to examine the formation of a leader head on a dynamic basis. In solving the problem step-by-step on an IBM 704, extensive use was made of the compiler. The program was rewritten five times as changes were made in the theory and in the form of the empirical equations.

Over 100 cases were computed, each representing some 16 hr of hand computation. Computer running time per case was 20 sec. Programming and reprogramming the problem five times while the theory was developed took about 3 man-weeks and about 4 hr of computer time. Accounting for the engineer's time at a standard rate, including overhead, and the computing time at commercial rates, the computation was completed at one-third of the hand-calculation cost.

This example of the use of compiler programming illustrates a case in which a high-power computer was used in the cut-and-try development of a theory. Such an application, in which reprogramming was the major expense, would be prohibitive costwise if regular symbolic programming were used. This is a superlative example of new digital computer applications created by compiler programming.

A transmission system with several short stub lines protected by a single lightning arrester on an incoming line was analyzed for travelling wave propogation on the IBM 704. Some 20 cases were calculated, each with 400 points representing a 4-μsec elapse of time. This problem was programmed in Fortran. Programming and debugging took 30 min of computer time and 25 man-hr by an engineer without previous computer experience. Hand calculation would have taken about 300 hr and probably would have not been tried.

To calculate circuit breaker recovery voltage following a system fault, a general program was desirable that would develop the driving point impedances as ratios of two polynomials in the operator s. This would

Progress Toward Simplified Programming

1. Machine Language—The first programs were written directly in the number system (machine language) used by the computer. A program in basic machine language, to add two numbers and place the sum in a third location, looked like this:

Instruction	Address	Meaning (code)
000101000000	001100010	Clear Accumulator, Add
000011000000	001100011	Add
000101000001	001100100	Store

A very complicated program could not be written in this cumbersome machine language. Even if the many numerical codes were remembered, the chance of a transcribing error was very great.

2. Symbolic Language—An obvious improvement was a symbolic notation to reduce transcribing errors and reduce the need for memorizing codes. Written in a symbolic mnemonic language, the above program is:

Instruction	Address
CLA	FIRST
FAD	SECOND
STO	SUM

Mnemonic symbols were hand translated to machine language once the problem was programmed.

3. Assembly Programs—Translation routines were developed that instruct the machine to translate mnemonic symbols into machine language. A more general translator includes a library of frequently used subroutines, such as trigonometric functions and input-output. This is known as an assembly program and includes subroutines called by address symbol only. An instruction to include a square root subroutine would be written:

Instruction	Address
LIB	SQRT

The assembly program technique was disadvantageous in that a calling sequence had to be written each time the subroutine was used.

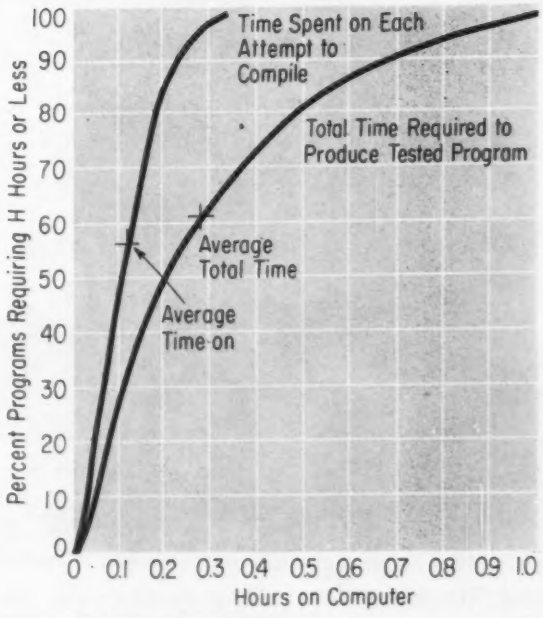
4. Interpretative Programs—The next development was interpretative programming which permits the use of psuedo-instructions which the translator accepts and changes to some arbitrary code. The translator includes in the machine language program as a subroutine the interpretative program that interprets the

be used with a package program available for taking the inverse of Laplace transforms. A program was written with the Fortran compiler that would combine RLC impedances and develop driving point functions with degree as high as s^{50}. Computer running time was 3 min per typical case, while hand calculation time is estimated at 8 hr. Programming time was 30 man-hr by an engineer without previous experience. About 10 min of computer time was needed for programming.

A second recently developed program investigates the speed of the induction-motor drive for an exciter during the recovery period following a fault on the main turbine-generator terminals. This program calculates speed step-by-step to determine whether the induction motor will stall. Included are all the time constants of the main turbine-generator and the exciter m-g set, expressed in appropriate equations for computer solution. As in other examples, this program was written by an engineer with power-system background but not specially trained in the techniques of digital computer programming.

To broaden the base of computer usage and to "computer orientate" the man with the problem, a Fortran Service has been inaugurated. Reference material, two hours of instruction, and occasional assistance from the Fortran Service group are all that is necessary to make the computer available to the engineer. Operation of the computer, preparation of cards, and so forth, are handled by Fortran Service.

Experience during the first three months of Fortran Service operations has been extremely favorable. Computer time required to prepare and check a program, including errors in analysis as well as programming, is presented in the accompanying curves. The average computer use per "time on" is 0.12 hr and the average total computer time required to compile and check the program for a technical problem is 0.28 hr.



COMPILING AND TESTING HISTORY with the Fortran Service shows that each attempt to compile took an average of 7 min; 80% of problems were computer tested in 30 min

Cost of programming, compiling, and checking a Fortran Service program is estimated to be less than 25% of the cost of preparing the same program in symbolic language. The elapsed time until completion of the program is correspondingly reduced.

psuedo-instruction properly. To handle instructions for multiplying complex numbers in a machine that handles real numbers only, the interpretative routine would be called for by writing CMP plus the calling sequence to enter the interpretative routine.

5. Compiler Programs—This latest technique permits the programmer to write the problem in English and algebraic statements. The computer accepts these statements, and organizes them into a near-optimum symbolic program. An assembly program translates the symbolic program into machine language. Thus, to add two numbers and place the sum in a third location, the problem for the Fortran compiler would be written:

$$\text{SUM} = \text{FIRST} + \text{SECOND}$$

This algebraie-English statement is organized into three symbolic statements, shown in (2), by the compiler and subsequently translated into the binary code of machine shown in (1). The single statement is called the source program; the binary machine statements are the object program. All steps from source to object programs are done automatically by the computer.

How Fortran Simplifies Program Writing

Arithmetic Statement:

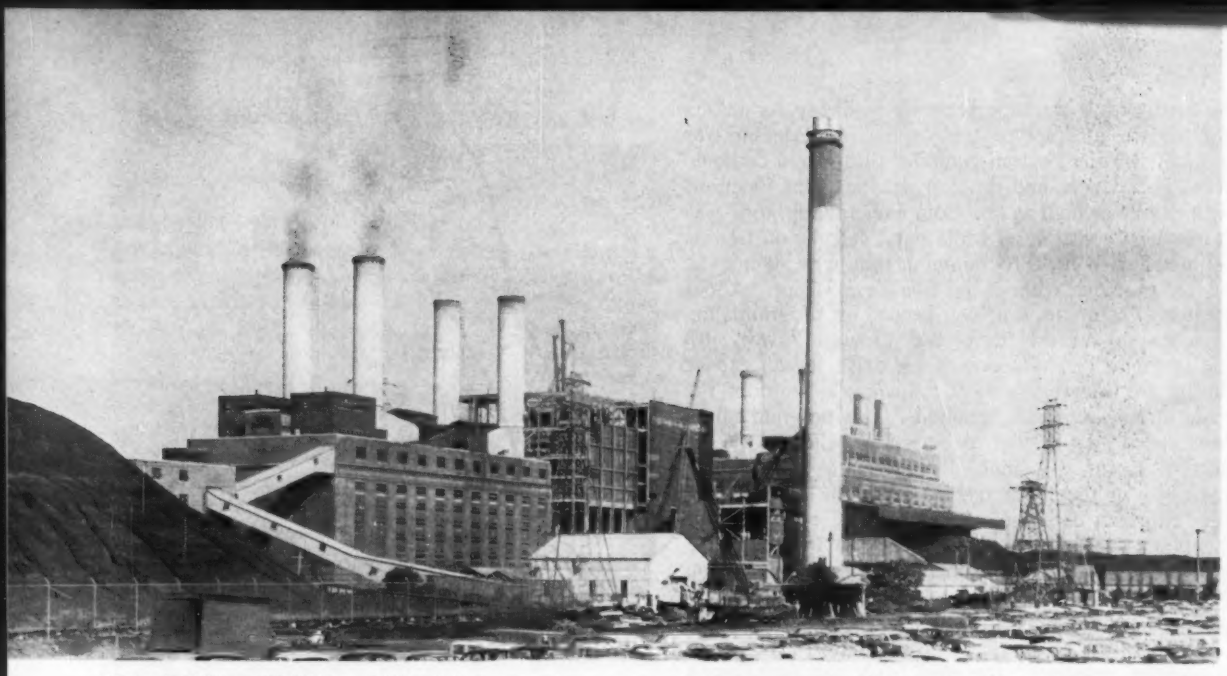
$$FC = \frac{DL-A}{A} + 0.25\left(1 + \sqrt{8 + \left[\frac{4}{A}(DL-A) + 1\right]^2}\right)$$

Compiler Statement:

```
2511  FC = (DL-A)/A+.25+.25*SQRTF(8.+(4.*(DL-A)/A+1.)**2)
```

Symbolic statements are developed in computer. These are translated by an assembly program into the binary machine language which the computer uses.

```
68A CLA DL      LXD 6) + 4, 4
FSB A           STO 1) + 2
STO 1) + 1      LDQ 3) + 4
FDP A           FMP 1) + 2
FMP 3) + 2      STO 1) + 3
FAD 3)          CLA 1) + 1
STO 1)          FDP A
LDQ 1)          STQ 1) + 4
FMP 1)          CLA 1) + 4
FAD 3) + 5      FAD 3) + 4
SXD 6)+4,4      FAD 1) + 3
TSX SQRT,4      STO FC
```



FOUR OBSOLETE UNITS in middle of the station were removed so new units could take advantage of common facilities

Plant Modernization Ups Capacity

Capacity at Huntley Station of Niagara-Mohawk Power Corp is increased fourfold by replacement of old 25-cycle equipment with two modern, 200-Mw 60-cycle units

F. S. **HELFTER**, System Project Engineer, Steam Stations, Niagara Mohawk Power Corp., Buffalo, N. Y.

TURBINE ROOM DEMOLITION was difficult because of the proximity to operating units. Completely different foundations were required in the plant

Replacement of old 25-cycle equipment with two modern 200-Mw, 60-cycle units at the Huntley Station has resulted in considerable savings.

Because utilization of an existing site postponed the immediate need for a new plant site and transmission right-of-way a sizeable saving can be credited to the Huntley project.

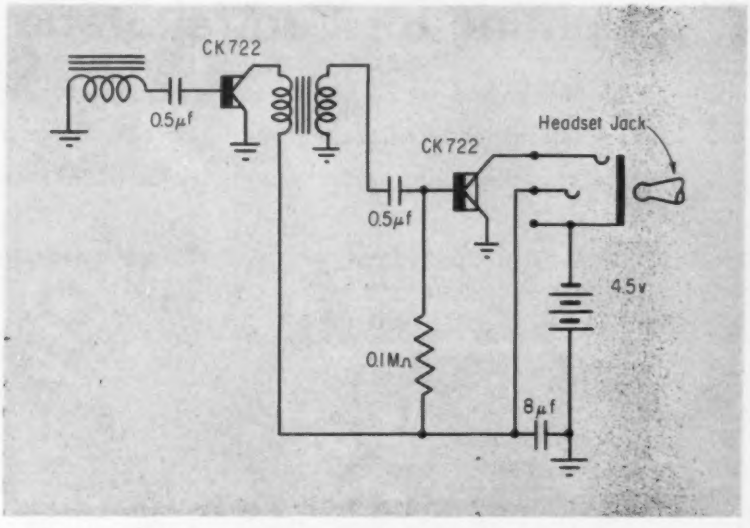
There is an additional savings in common facilities such as car dumper, boat unloader, coal conveyors and breakers, shops and offices, locker and storerooms, and circulating water intake, etc. Further savings are made in top supervision and in operating and maintenance personnel when compared to requirements of a new station.

With the modernization program completed, two turbine generators having a total capacity of 400 Mw are now installed in the same room that formerly housed four units totaling 95 Mw.

The units removed from the station included three 20-Mw units installed in 1916 and one 35-Mw unit installed shortly after. All of the

(Continued on page 42)

COMPACT PROBE, ruggedly constructed, absorbs shocks of field use



DETECTION CIRCUIT employs two transistor amplification stages. Three 1½-v batteries provide power. Battery life is several months with normal use

Transistor Probe Locates Buried Cable

CARLA BAROCCIO, Viale XXI Aprile, 12, Rome, Italy

A transistorized probe, developed by the research laboratory of S. R. E., Rocca Priora, Italy, locates underground conductors easily. Soil depth of the cable is also readily determined. Rugged construction eliminates problems such as large size or delicate construction encountered in vacuum tube instruments.

The probe consists of a coil wound on a laminated iron core coupled to a transistor circuit containing two amplification stages. It is housed in a ⅞-in. diameter x 30-in. long insulating tube. Power is supplied by three 1½-v batteries contained in the same tube. Detection is acoustical, using a headset connected to the probe by a jack plug.

A signal generated by a 1,000-cyc impulse oscillator is introduced on one end of the cable to be explored, while the other end is grounded. The probe coil detects the 1000-cyc signal produced by the electromagnetic field around the cable. The probe is held vertically to determine conductor location. A minimum signal is heard through the headset when the probe is directly over the cable.

Conductor depth is found by tilting the probe at a 45-deg angle to the soil surface. Acoustic intensity will be minimized at two points equidistant from the position where cable location is determined. The distance of one of these points from the location point is equal to the depth of the conductor under the surface of the soil.

Photo Technique Eases Aesthetic Study

M. W. STUMPF, Principal Electrical Engineer, New Orleans Public Service inc, New Orleans, La.

A novel photographic technique facilitated an aesthetic study of different types of overhead construction on city streets by New Orleans Public Service, Inc.

First step in the technique was to photograph a residential street and print a large photo. Next, the different types of overhead construction were drawn in perspective on transparencies. Each transparency, in turn, was laid over the enlarged photo and the combination photographed. The resulting prints provide a realistic means of comparing various types of construction available.

To facilitate the comparison and handling, the prints were secured to an easily-folded cloth.

Lighting for Central Station Locations

Table lists recommended levels of illumination for various specific eye tasks in central station locations and related areas. These data are adapted from the footcandle tables issued recently by the Illuminating Engineering Society.

CENTRAL STATION INDOOR LOCATIONS	Ft-c*
Air-conditioning equipment, air preheater and fan floor, ash sluicing	10
Auxiliaries, battery rooms, boiler feed pumps tanks, compressors and gauge area	20
Boiler platforms	10
Burner platform	20
Cable room, circulator or pump bay	10
Coal conveyor, crusher, feeder, scale areas, pulverizer, fan area, transfer tower	10
Condensers; deaerator, evaporator, heater floors	10
Control rooms	
Vertical face of switchboards	
Simplex or section of duplex facing operator, at 66 in. above floor	
Type A—Large centralized control room	50
Type B—Ordinary control rooms	30
Section of duplex facing away from operator	30
Bench boards (horizontal level)	50
Area inside duplex switchboards	10
Rear of all switchboard panels (vertical)	10
Emergency lighting, all areas	3
Hydrogen and carbon dioxide manifold area	20
Chemical laboratory	50
Precipitators	10
Screen house	20
Soot or slag blower platform	10
Steam headers and throttles	10
Switchgear power	20
Telephone equipment room	20
Tunnels or galleries, piping	10
Turbine bay sub-basement	20
Turbine room	30
Visitors' gallery	20
Water treating area	20

GARAGES—AUTOMOBILE AND TRUCK	Ft-c*
Service garages	
Repairs	100
Active traffic areas	20

TESTING	Ft-c*
General	50
Extra fine instruments, scales, etc	200**

CENTRAL STATION OUTDOOR LOCATIONS	Ft-c*
Catwalks	2.0
Cinder dumps	0.1
Coal unloading	
(a) Dock (loading or unloading zone)	5.0
(b) Barge storage area	0.5
(c) Car dumper	0.5**
(d) Tipple	5.0
Coal storage area	0.1
Conveyors	2.0
Entrances	
Generating or service building	
(a) Main	10.0
(b) Secondary	2.0
Gate House	
(a) Pedestrian entrance	10.0
(b) Conveyor entrance	5.0*
Fence	0.2
Fuel oil delivery headers	5.0
Oil storage tanks	1.0
Open yard	0.2
Platforms—boiler, turbine deck	5.0
Roadway	
(a) Between or along buildings	1.0
(b) Not bordered by buildings	0.5
Substation	
(a) General horizontal	2.0
(b) Specific vertical (on disconnects)	2.0

OFFICES	Ft-c*
Cartography, designing, detailed drafting	200
Accounting, auditing, tabulating, bookkeeping, business machine operation, reading poor reproductions, rough layout drafting	150
Regular office work, reading good reproductions, reading or transcribing handwriting in hard pencil or on poor paper, active filing, index references, mail sorting	100
Reading or transcribing handwriting in ink or medium pencil on good quality paper, intermittent filing	70
Reading high contrast or well-printed material, tasks and areas not involving critical or prolonged seeing such as conferring, interviewing, inactive files and washrooms	30
Corridors, elevators, escalators, stairways	20†

* Minimum on the task at any time

** Obtained with a combination of general lighting plus specialized supplementary lighting. Care should be taken to keep within the recommended brightness ratios. As far as possible the installation should eliminate direct and reflected glare as well as objectionable shadows.

† Or not less than 1/5 level in adjacent areas.

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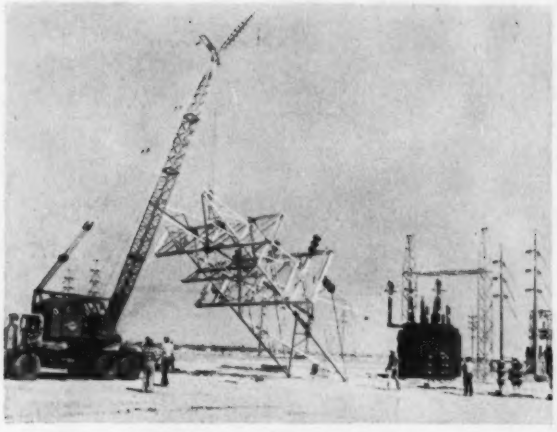
General Electric Demand Registers Now Provide Time Intervals from 15 Minutes to 4 Hours

General Electric's M-30 indicating and M-31 cumulative demand registers provide time intervals ranging from the customary 15, 30, or 60 minutes up to the 4-hour standard now being considered by the electric utility industry. Such a wide latitude of demand-metering time intervals is desirable to adequately reflect the highly diversified demands of modern appliance loads. With G-E demand registers, therefore, promotion of load-building can be more compatible with equitable recovery of fixed service costs.

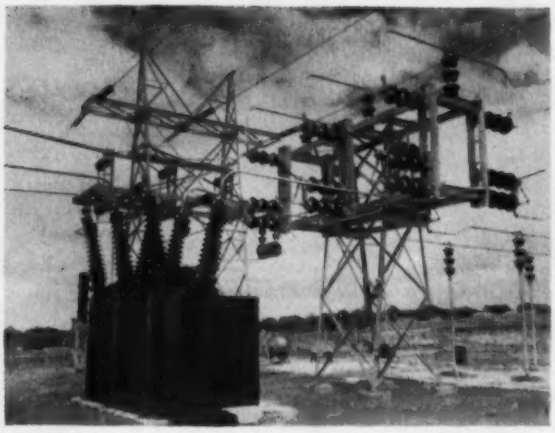
General Electric registers best solve the problem of flexibility, too, since changes in voltage rating, scale class, and time interval can be made easily and economically. Your General Electric apparatus salesman will be glad to tell you more about these two versatile mechanical demand registers. Or, write to General Electric Company, Section 628-24, Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC



GROUND ASSEMBLED, the A tower is set by crane. The tower can be set in 15 min once the crane is positioned



COMPACT B STRUCTURE is low enough to allow proper clearance under strain buses strung across substation yard

Basic Structures Cut Substation Cost

M. A. HARKNESS, Senior Electrical Engineer, Public Service Co of New Mexico, Albuquerque, N. M.

Three standard steel structures provide the basic components around which Public Service Co of New Mexico is erecting 115-kv ring-bus switching stations and substations. This modular approach has made possible easily laid-out, quickly erected, economical stations. Total cost for a five-circuit, five-breaker 115-kv switching station using these structures was $120,000 per breaker. Substantial credit for this low cost, which also included land, control building, fencing, design, etc, is attributed to the modular structures.

Every effort in initial design was directed toward standardization, duplication and simplification. As a result, virtually all structural steel evolved into these basic components: Type A deadend tower, Type B disconnect tower, and insulator support column. Only minor supports, for such equipment as lightning arrestors and potential transformers, require different basic steel assemblies.

Space economy of the standard structures has permitted the ring-bus arrangement to be installed within the same general overall yard dimensions previously allocated to the double-bus bus-selector scheme.

Public Service adopted the ring bus in all 115-kv stations for economy. The Type A structure was especially designed for ring-bus use, but it is easily adaptable to breaker-and-a-half or double-bus-double-breaker schemes. It also is used as the high-side structure for step-down transformers off the 115-kv system and for intermediate strain bus support within a station.

The Type A deadend tower is designed to hold two shield wires at 45-ft elevation and three phase wires at 35 ft, with a 9,000-lb max tension per conductor up to 15-deg take-off angles. Incoming lines can be brought directly to station structures at normal stringing tensions without a maze of deadend structures in the immediate vicinity.

By addition of switch trusses, the tower will support vertically-mounted gang-operated disconnect switches on either or both sides. This permits mounting separate disconnects for lines and transformers, and thus avoid breaking the ring during maintenance.

The Type A tower can be assembled on the ground, with insulators and disconnects mounted and adjusted. The whole assembly, weighing 10,350 lb with crossarm and switch-mounting trusses, can be lifted by crane and set on its foundation. Tests at four sites show a fully-assembled tower can be lifted and set in 15 min.

The Type B disconnect tower was designed principally to support two sets of vertically-mounted gang-operated disconnect switches. With bottom truss omitted, this tower can be used to support a strain bus at 23.5-ft elevation. It is similar to the Type A tower.

The insulator support column is used widely to support rigid HV buses. Public Service 115-kv stations use a standard 4-in. IPS galvanized pipe with bracket welded to the top to mount a stack of 5-in. bolt-circle insulators and carry a rigid 2-in. IPS aluminum bus at 15- or 16-ft. elevation.

The pipe is set directly into the foundation, allowing bus elevation to be adjusted to meet local conditions by merely changing depth of pipe setting. Where station expansion required relocation, columns and their original foundations were moved as units.

Public Service prepares its own steel detail drawings, furnishing them to steel suppliers with bid requests. With all suppliers bidding and working from the same detail sheets, bids are easily analyzed. Steel members from different suppliers are interchangeable. Switch trusses supplied by one fabricator have been installed without field-drilling on towers furnished by another.

Standardization on steel structures has led to standardization of foundations and other substation components, minimizing engineering time. Design draftsmen can make substation layouts with a minimum of engineering supervision.

ANOTHER GENERAL ELECTRIC

Kilovar Plus...

New Twin-cluster Equipment Puts More Capacitors on the Pole

- More capacitors per pole—up to 1200 Kvar for 15 Kv systems, and 900 Kvar for 24.9 Kv systems
- Lower cost per installed kilovar than for smaller rated pole-top equipments
- Perfect balance of twin capacitor racks practically eliminates bending moment on pole

YOU GET MORE CAPACITORS PER POLE—at a lower installed cost per kilovar—with General Electric's new twin-cluster equipment. New design allows up to 1200 Kvar to be installed using the same pole space required by a 600 Kvar in-line equipment. Higher ratings further decrease the cost of switched capacitors by reducing the switch and control requirements per kilovar.

LIGHTWEIGHT STRUCTURAL ALUMINUM RACKS and stainless steel capacitor cases require no protective paint maintenance, helping to cut maintenance costs.

FACTORY-ASSEMBLED racks and compression-type cluster brackets make installation fast, easy and inexpensive.

AMPLE CLIMBING SPACE between racks—over 30 inches—provides linemen with easy access to equipment for installation, connection and inspection.

SEE FOR YOURSELF how General Electric's new twin-cluster capacitor equipments can help put more kilovars on your system at less cost. Contact your nearest G-E Apparatus Sales Office, or write to Section 445-23, General Electric Co., Schenectady, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Plant Modernization Ups Capacity *(Continued from page 36)*

units provided 25 cycle power and although the equipment was in operable condition, some disposition of it would have been necessary in the near future as 25-cycle load fades out of the picture.

The new 400-Mw, 60-cycle capacity will be provided by two 200-Mw units. They will be cross compound, single flow exhaust machines with steam conditions of 2,400 psi, 1,050F/1,000F. The 75-ft narrow bay width of the existing turbine building influenced the type of units purchased. The estimated cost of the first unit is $31 million and that of the second $26 million.

After the obsolete units were demolished and sold for scrap, their turbine and boiler concrete foundations were removed and steel caissons were sunk to support the new equipment. The caissons were sunk 40 ft to rock and filled with reinforced concrete. This required driving sheet piles inside the building adjacent to operating units—a very delicate operation.

Plant Shutdown Avoided

In addition, it was necessary to keep common facilities in operation. Many of the steam, water, heating, and fire lines had to be relocated in order to maintain service to the remaining operating units. The electrical house service layout had to be revised in order to maintain reliability after the four old units were removed.

Although the same intake forebay was used, a curtain wall was installed to replace floating log booms to more effectively deflect ice and debris. A new pump house was built adjacent to the screenhouse and reinforced concrete pipes connected the pumps to the condenser as the old concrete water tunnels had to be removed due to the new turbine foundation interferences. The water tunnels to the older units remaining in operation were kept in service by installing stop logs at the spur which formerly supplied the condensers that were removed.

The units that were removed in the modernization program were situated in the middle of the plant. This of course complicated the construction work. But it was the logical thing to do because the original 25 cycle plant expanded toward the south (there are still three 25 cycle machines intact) and then later the 60 cycle plant was built to the north. The common facilities were between the two different parts of the plant. If the newer 25 cycle equipment to the south were retired instead of the old equipment in the middle less use could have been made of the common facilities.

Unit Has Single BF Pump

The desirability of having new efficient equipment is dramatically apparent from a comparison of it with the equipment that was removed. Instead of several boilers per turbine generator the new units have a single boiler per machine. In fact the unit design will be carried to the ultimate by the use of a single steam-driven boiler feed pump with the second new unit. This pump will have no cross connections with the other unit.

The first 200-Mw unit will have two steam-driven, boiler feed pumps. Variation in load will be accomplished by varying turbine speed.

Automatic combustion control of the pulverized coal, corner fired boilers is an impressive tribute to the progress that has been made since the original stoker fired boilers were installed at Huntley.

Another new feature of the modernized station is a three nozzle discharge flue in the stack. Two of the nozzles are provided with motor operated control dampers so that high discharge velocity of the exit gases can be maintained even at partial loads.

West Germany's Boom *(Continued from page 26)*

The increase will be met largely through additions to existing thermal and hydro plants supplemented by nuclear plants.

A survey by the Federal Economics Ministry in Aug., 1957 estimated annual total consumption in 1965 at 172-billion kwhr, in 1970 at 224-billion kwhr and in 1975 at 284-billion kwhr. The Ministry makes the following estimate of how installed capacity will supply the nation's needs:

Installed Capacity
(Thousand Mw)

	1965	1970	1975
Hydro	3.6	4.0	4.3
Brown-coal	8.3	11.2	12.8
Nuclear	0.5	1.5	5.0
Bituminous coal, other	24.9	31.0	37.7
Total	**37.3**	**47.7**	**59.8**

In the atomic energy field, the Atomics Ministry expects to see four to five power reactors with a net output of 500 Mw in operation in West Germany by 1965. Of five groups actively participating, a Brown, Boveri & Cie-Krupp group is the only one working on a purely German design.

A group of public utilities has ordered a 15-Mw pilot unit of the high-temperature, pebble-bed type with ceramic fuel elements from BBC-Krupp, and if operating experience is satisfactory would order a 100-Mw unit.

Allgemeine Elektrizitaets Gesellschaft, in cooperation with General Electric, has sold a light-water pilot plant to RWE, also as a preliminary for a full-scale power reactor. German Babcock & Wilcox using the experience of its English namesake, is developing an advanced, gas-cooled graphite-moderated reactor. Siemens-Schuckert in cooperation with Westinghouse is offering a heavy water moderated and cooled reactor utilizing natural uranium. The fifth group is Interatom—a 50-50 subsidiary of the Atomics International division of North American Aviation and the giant German mechanical engineering firm of Demag. Interatom's proposals are based on the American organically moderated and cooled reactor, OMR.

Investment in power plants for the next ten years is estimated at between $4 and $5 billion, in part depending on utilization of atomic energy.

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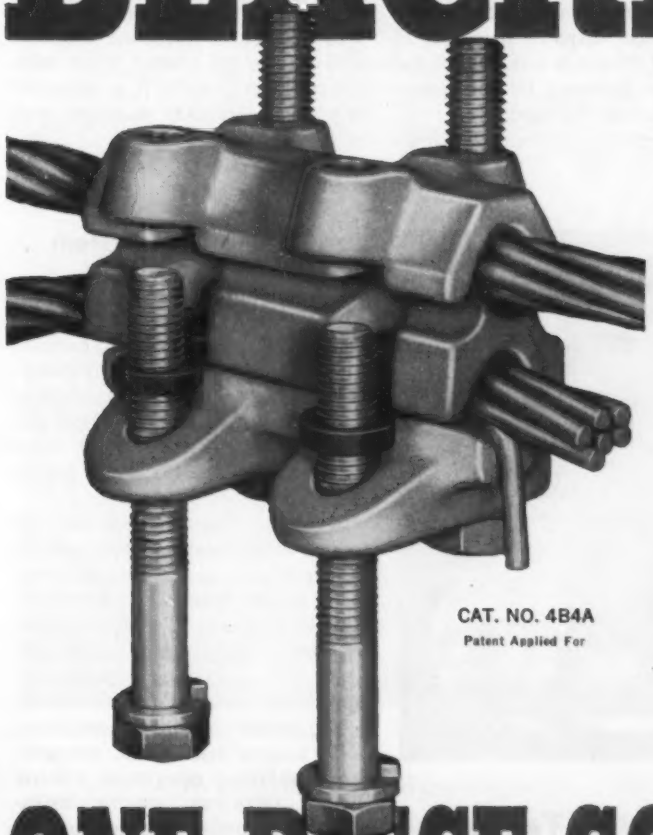

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It's here... a heavy duty one-piece 4-bolt connector with all the electrical and mechanical advantages of a U-bolt connector... yet much easier to install.

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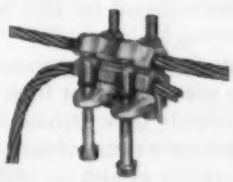
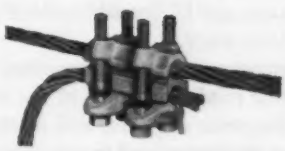


Insert tap wire.



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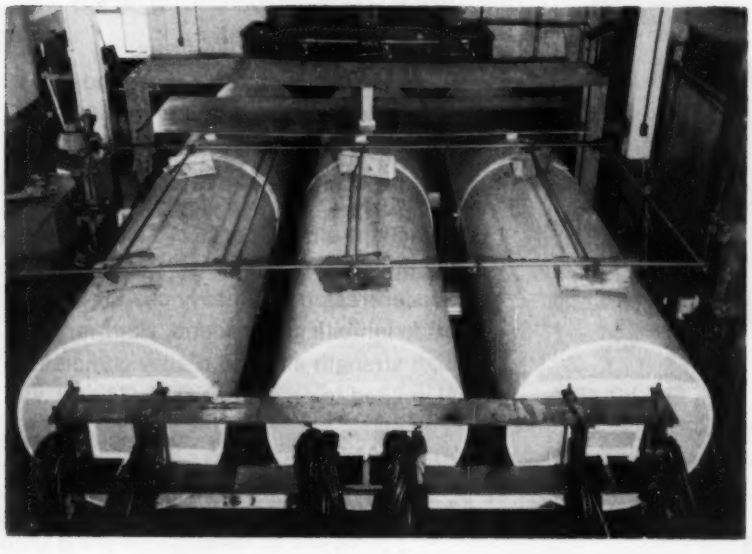
Manufacturers News

Westinghouse Installs Fully Automatic Communication System

A high-speed communication system went into operation in mid-November to link Westinghouse Electric Corp's 102 plants and 142 sales offices. It consists of an automatic teletypewriter network made up of 23,750 miles of circuits leased from the American Telephone and Telegraph Co.

The automatic system replaces the manual one used by the company and speeds up receipt of messages to 5-10 min from over 30 min formerly required. No rerouting is involved, and messages can be routed to several points at once and be received simultaneously. Relay devices dispatch messages at a speed of 75 words a minute to the destination indicated by a dispatch code placed on the tape.

Three teletype systems are integrated into the network. One links 158 Westinghouse locations east of the Rocky Mountains from a control center in Pittsburgh, Pa. The second control center is in San Francisco, linking 26 stations on the West Coast. A third line connects networks in the United States with a network in Canada. It is estimated that some 260,000 messages will be conveyed each month.



Delta-Star Buses Run Gamut of Tests

Upon completion of post-construction tests by Delta-Star Electric Division of H. K. Porter Company, Chicago, Ill., isolated-phase buses will be installed in power plants located in Fairbanks, Ind., and Graham Station, West Va. Capacity of each of the two turbine generator units at each station will be 450 Mw. The buses will carry 11,000 amp at 23-kv from the generators to step-up transformers.

Shown are telescopic, isolated-phase buses arranged for tests in Delta-Star laboratory.

Extensive testing was required because steel structural components and concrete reinforcing rods of the buses were affected by heat from induced and magnetic currents, and extent of heat effects upon ferrous materials had to be determined in advance. Other tests were run to determine conductor size and cover heating. Overcurrent effects as high as 16,000 amp were studied.

Conductors for the buses will be circular aluminum tubing. Housings will be constructed of ¼-in. aluminum sheet. Insulators will provide a 4-point mounting, so that some porcelain will be in compression whatever the type or manner of short circuit.

Con Ed's Control System To Be Built by Panellit

A $235,000 electronic control system including panels and cubicles will be designed and built by Panellit, Inc, Skokie, Ill., for Consolidated Edison Co's first nuclear power station. It will be located 24 miles north of New York City at Indian Point, Westchester County.

A central control room over 80 ft long will contain all the controls for the reactor and electrical equipment, according to Albert F. Sperry, Panellit president. To protect plant personnel, one section will be devoted to radiation monitoring equipment.

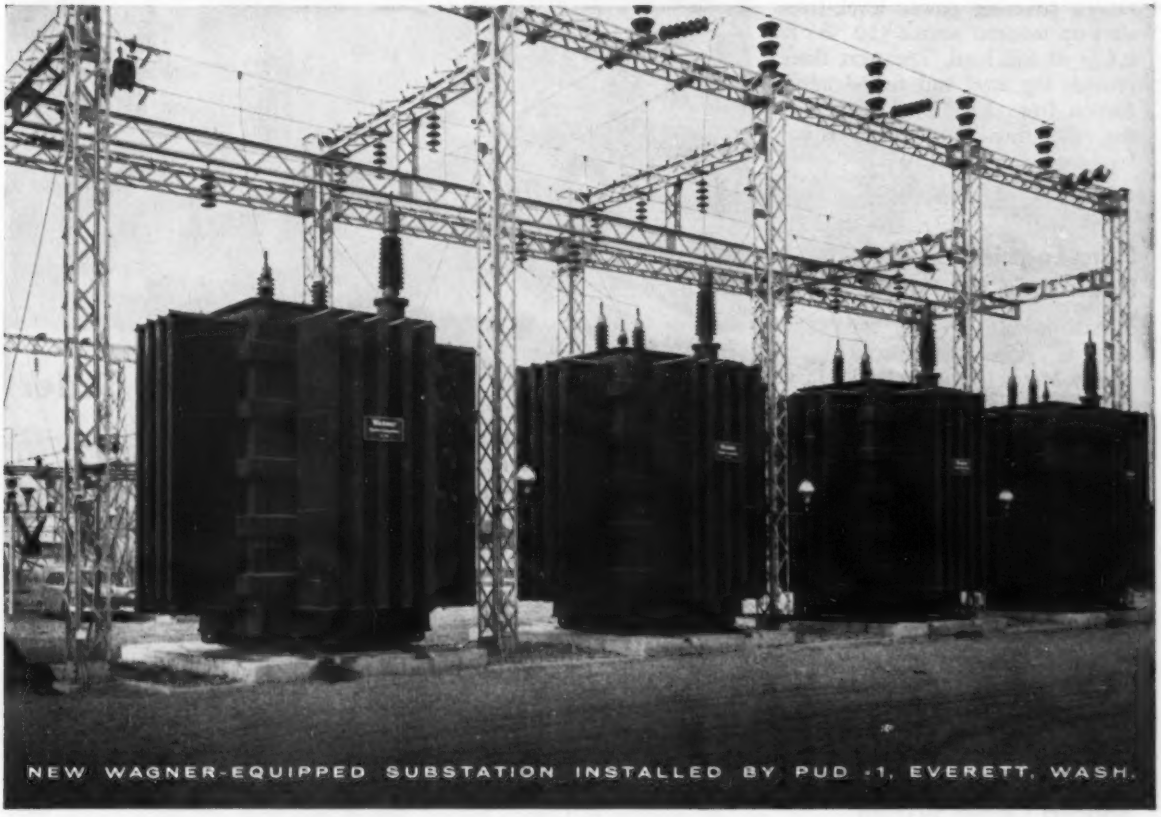
The system contains annunciators, boiler control instruments, temperature monitoring equipment, electric meters, recorders, reactor instrumentation, control switches, and indicating lights.

In sharp contrast to conventional power plants, many reactor instruments are duplicated and triplicated to insure safe and continuous operation. There are several other differences between nuclear and conventional boiler instrumentation: (1) Neutron density in the reactor is the primary variable instead of the fuel firing rate. (2) The variable's range is from 10^{-8}% to 150% of power level instead of from 1% to 100%. (3) Linear power and log power level is displayed and recorded instead of steam flow, temperature, etc. (4) Control and safety system information provided, whereas these are entirely separate on conventional boilers.

(Continued on page 46)

MORE WAGNER TRANSFORMERS

add system capacity for Snohomish County



NEW WAGNER-EQUIPPED SUBSTATION INSTALLED BY PUD #1, EVERETT, WASH.

With system demand growing at the rate of 9% annually, Snohomish County PUD is adding capacity with more and more transmission and distribution substations.

This recently completed substation is equipped with four Wagner single-phase power transformers rated 10,000/13,333/16,667 kva, 110,000 GrdY to 55,000 Delta Volts.

Wagner builds standard and special power transformers to meet practically all kva and voltage requirements. Consult Wagner about your next power transformer installation. 32 branch offices are at your service. Wagner Bulletins TU-181 and TU-16D tell the whole story. Write for your copies today.

Wagner Electric Corporation
SERVING INDUSTRY SINCE 1891

WT58-14

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

Con Ed's Control System

(Continued from page 44)

Ten information channels are provided in the Panellit system. The first four channels are start-up ranges covering power level from start-up neutron source (10^{-8}%) to 0.1% of full load. The next three provide log level and period information from 10^{-8}% to 100% and the other three show linear power level from 0.1% to 150%.

Data-Logging System Duplicated for Power Show

An operable data-logging system is being demonstrated by Bailey Meter Co, Cleveland, O., at the 23rd National Power Show being held in the New York City Coliseum this week, Dec. 1-5.

The Metrotype information system will operate simultaneously with Bailey's data-logging system for making 145 operating measurements at the Milliken Plant of New York State, near Ithaca, N. Y. Actual impulses will be transmitted by leased wire for logging on duplicate equipment in the booth.

Roebling Adds 15-kv Aerial Spaced Cable System

Roeclamps with associated cables are now available for 15-kv circuits. This is an extension of the 5-kv and 8-kv systems developed by John A. Roebling's Sons Corp, Trenton 2, N. J.

The Roeclamps are a clear plastic tested to 1800-lb breaking strength. Insulated aluminum or copper conductors fit into grommets located on 7-in. centers. Phase additions or changes are made easily by loosening a big nut and without removing the Roeclamp from the messenger. Manufacturer advises only 34 clamps are required every 1,000 ft.

Anaconda's Earnings Climb With Copper Price Increase

Earnings of Anaconda Co, New York, N. Y., improved notably in the latter part of the third quarter of 1958, due to gradual increase in the price of copper. Since accessment showed this trend for period ending September 30, price of copper has gone up even further.

Subject to year-end audit and adjustments, consolidated net income for the first nine months of 1958 amounted to $19,288,460, or $1.80 per share on 10,714,627 shares of capital stock outstanding. For the same period of 1957, net income was $34,980,127, or $3.36 per share on 10,409,191 shares of capital stock outstanding at that time. Deliveries for first 9 months of 1958 exceeded production by 26,600 tons.

Federal Pacific Ships Major Relay Order

Federal Pacific Electric Co's first major order of protective relays—129 overcurrent and reclosing units purchased by the Bonneville Power Administration—are readied for shipment (shown above) at the firm's Newark, N. J., Relay & Instrument Plant. (EW, July 14, 1958, p. 76)

The company received another order, valued at $750,000, to build electrical distribution and control apparatus for the Walter Reed Medical Center, Washington, D. C. Equipment to be supplied by Federal's Scranton, Pa., and Cleveland, O., plants includes transformers, power switchgear assemblies and motor controls.

The company is expanding further in Canada. It has acquired through an exchange of stock Cemco Holdings, Ltd, of Vancouver, B. C., and its subsidiaries, Cemco Electrical Manufacturing Co, Ltd, and Cemco Switchgear, Ltd. This was jointly announced by Thomas M. Cole, Federal Pacific president, and B. W. Ball, president of Cemco.

Acquisition of Cemco follows closely on Federal Pacific's recent purchase of its former Canadian licensee, Federal Pacific Manufacturing Co of Toronto. Their combined operations make Federal Pacific reportedly the fourth largest electrical manufacturer in Canada with plants in the country's eastern, central, and western market centers.

Rome Cable Engineer Develops Brazing Method

Rome Cable Corp's development engineer, Maurice G. Steele, has been awarded a U. S. patent for his system for electrically brazing solid and stranded wire, particularly copper wires. Use of two opposed mechanical metal clamps, one on each side of a standard carbon-block brazer on opposite electrodes, is the key to Steele's new method. Advantages are set forth as: Stronger brazes, minimum length of stiffened wire, minimum annealed length, and no distortion of wire shapes.

Chevrolet's new El Camino combines fresh beauty with a husky pickup box that's 76¼" long, 64¼" wide.

THE BEST YET OF THE BEST SELLERS...

CHEVROLET TASK·FORCE 59 TRUCKS

This 1959 Chevrolet Series 60 model is built to take it on bruising hauls; standard Jobmaster 6 is as reliable as it is economical.

For '59, the brightest new ideas in trucks are Chevrolet's! There's the new El Camino to set a new standard in styling... new features and refinements in every model to set new records for saving!

Here is the soundest, savingest, sharpest looking line of haulers that ever hustled a load! For evidence, consider the dazzling new El Camino. It combines slimlined beauty with the ability to handle man-size hauling jobs!

Or take the pickups of Task-Force 59—a *dozen* big-bodied beauties that suit scores of jobs with five handsome Fleetside models and seven handy Stepside models!

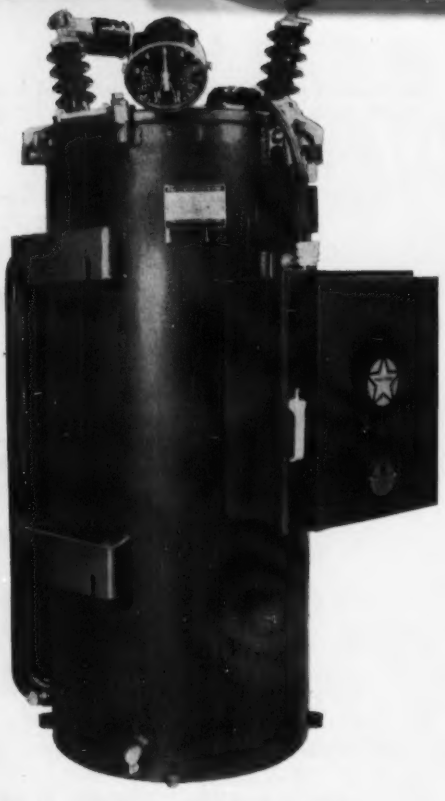
A new edition of the famous Thriftmaster 6, standard in light-duty models, gives up to 10% greater fuel economy—up to 20% with new maximum economy option*. And in the medium- and heavy-duty classes, you'll find new V8 power . . . axles, transmissions, frames and brakes that are refined and improved to whip the toughest runs.

Whether your truck is a light-, medium-, or heavy-duty job, these are trucks you've got to see! They're on display right now at your Chevy dealer's. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

**Optional at extra cost.*

NEW MIGHT, NEW MODELS, NEW MONEY-SAVING POWER! CHEVROLET

New Equipment



Voltage Regulators . . .

. . . in 27 distribution ratings provide automatic regulation in 32 steps of ⅝% each. The single-phase Pole Star regulators are available in sizes from 15 through 668 amp in voltages of 2,500 through 14,400 v. A special "Mor-Amp" feature permits the regulating capacity to be increased to 160% rated current at reduced range. Regulators with current ratings above 320 amp are equipped with a direct-drive tap changer. Both station-type and pole-type units are available.
Pennsylvania Transformer Div, McGraw-Edison Co, Canonsburg, Pa.

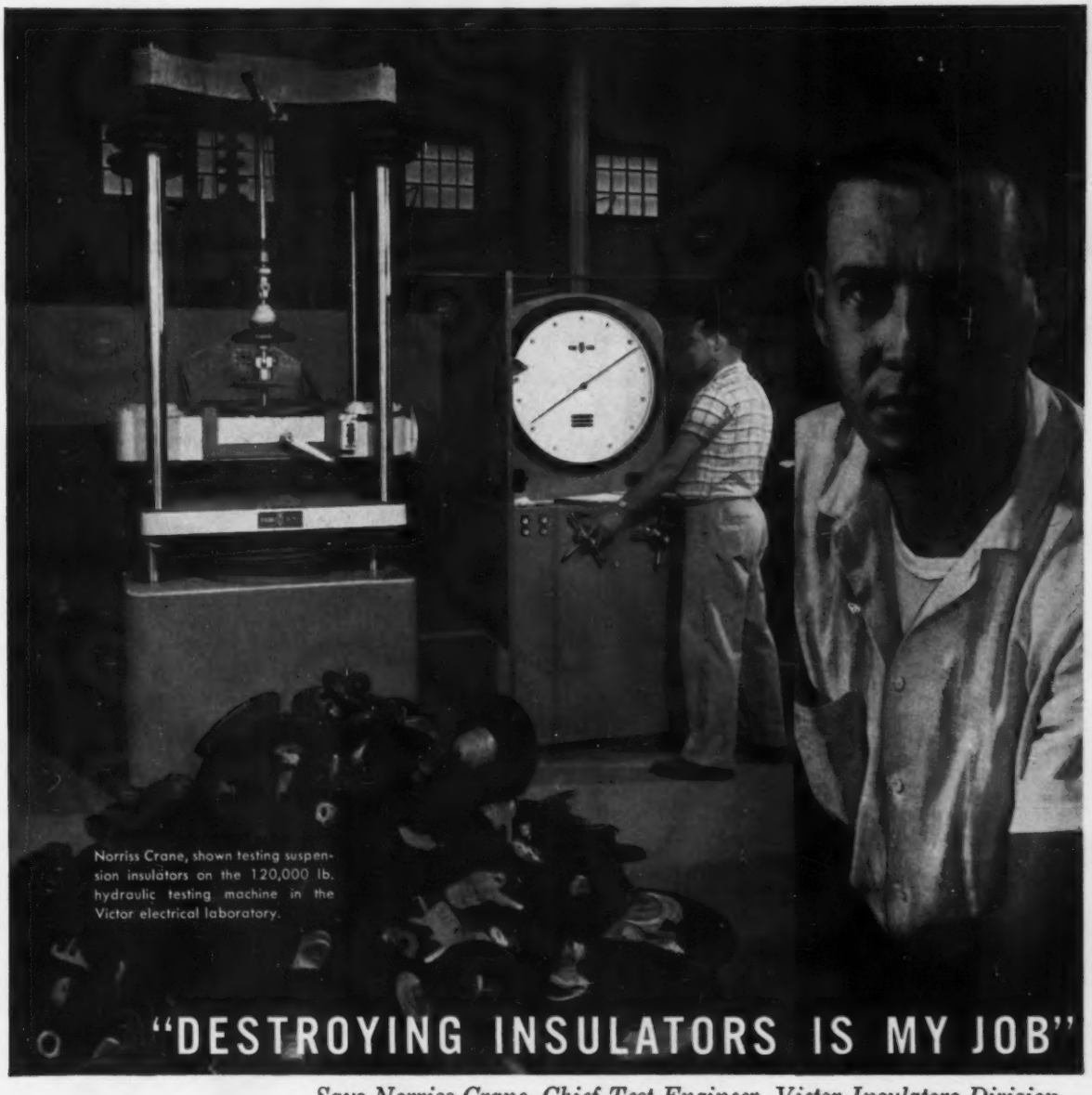
Plastic Spacer . . .

. . . is a feature of new overhead distribution system. A single size spacer is used for all voltages up to 15 kv, providing a 6-in. spacing between phase conductors. Spacers are placed about 30 ft apart along the length of the system. While either copper or aluminum conductors are applicable, hard-drawn aluminum with polyethylene insulation is standard. The system can be installed in locations where space is a problem.
Rome Cable Corp, Rome, N. Y.

Transformer Enclosures . . .

. . . house conventional pole-type single-phase transformers rated through 50 kva. In addition, the enclosures can accomodate secondary bus, arresters, cutouts, reclosers and meters if required. Shipped disassembled, the enclosures are being offered in 5 and 15-kv voltage classes. They are constructed of heavy gauge steel and have a lock for pad mounting.
Line Material Industries, McGraw-Edison Co, Milwaukee 1, Wisc.

(More New Equipment on page 50)



Norriss Crane, shown testing suspension insulators on the 120,000 lb. hydraulic testing machine in the Victor electrical laboratory.

"DESTROYING INSULATORS IS MY JOB"

Says Norriss Crane, Chief Test Engineer, Victor Insulators Division, I-T-E Circuit Breaker Company

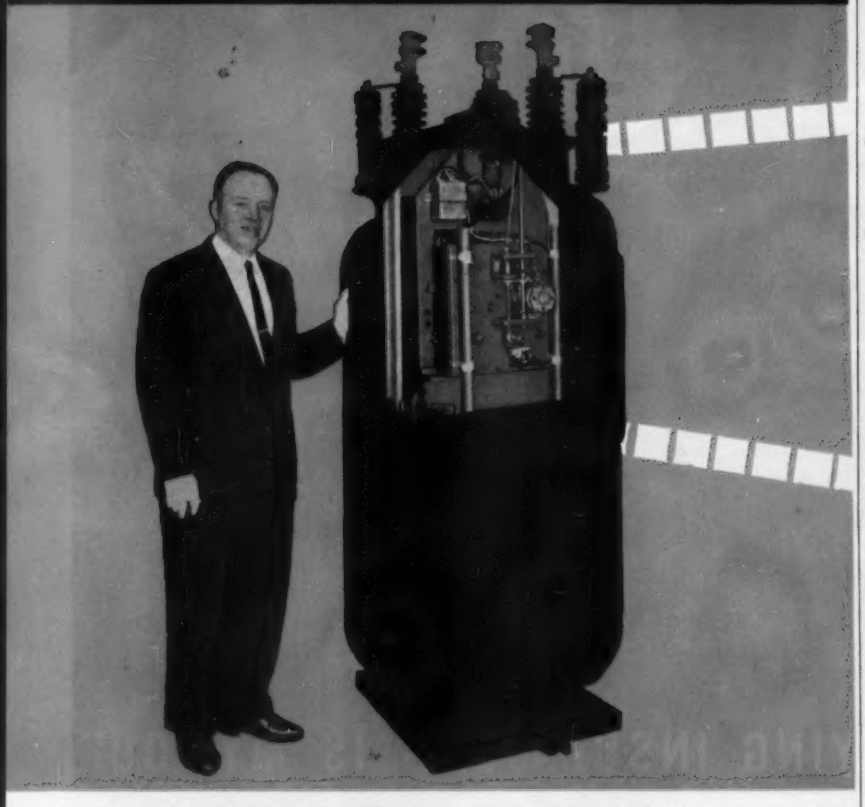
"The VICTOR insulators that go on your lines will never have to take the mechanical and electrical loading we give them in the VICTOR laboratory. Here, these insulators are subjected to stresses far in excess of the EEI-NEMA Standards. In fact, our continuous quality control testing program shows that VICTOR insulators proof-test at values as much as twice their EEI-NEMA ratings. Such a margin of safety precludes insulator failure on the line."

When you buy VICTOR, you buy practically twice the insulator you pay for. That's why we say: *"VICTOR is the power man's best bargain."*

I-T-E CIRCUIT BREAKER COMPANY, INC.
VICTOR INSULATORS DIVISION
Victor, New York

Ask your Westinghouse representative
about the exclusive benefits you get from

URL AND URF REGULATORS... "LIKE NEW" PERFORMANCE FOR TOMORROW'S LOADS



In Westinghouse URL and URF regulators, carbon accumulation *cannot* clog cooling ducts. Changing taps under load in a regulator requires interrupting an arc under oil and this arcing causes the release of free carbon. If not restrained, this accumulation *can* clog cooling ducts, reducing cooling efficiency and stealing load-carrying ability. Under heavier loads more carbon is released and in time overheating may become a problem.

A separate tap changer compartment in each URL and URF regulator keeps carbon out of the main tank oil. This prevents carbon build-up in the cooling ducts . . . cooling efficiency and load-carrying ability remain high.

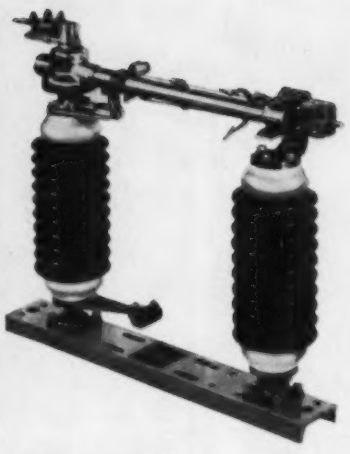
In feeder voltage regulators, only Westinghouse URL and URF regulators offer a separate tap changer compartment — at no extra charge. Here is your assurance that the full value of *like-new* performance will still be yours — even ten or twenty years from now.

See your Westinghouse representative for the full story of better regulation — from URL and URF regulators — made possible through PLOWBACK OF EARNINGS into research for the solution of the electric utility industry's immediate and long-range problems.

J-70895

YOU CAN BE SURE...IF IT'S **Westinghouse**

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS," CBS TV MONDAYS



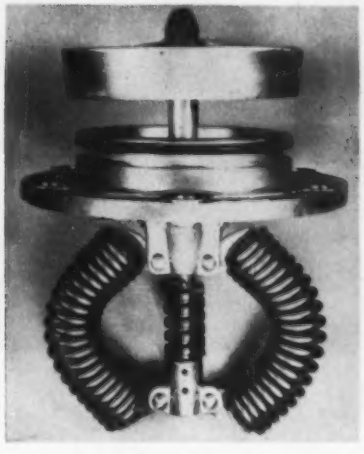
Airbreak Switch . . .

. . . has high speed dual arcing horns which are capable of interrupting charging currents on 100 mi of 69-kv line. The TECO Type 1-D switch is mounted on two insulators and is available in 600 and 1,200 amp sizes from 15 through 161 kv. High-pressure beryllium contacts are at all switch blade disconnecting points. Rotary motion of blade prior to opening releases contacts easily and positively at all times. **Turner Electric Co, 9510 St. Clair Ave, East St. Louis, Ill.**

Range Extender . . .

. . . for snap-around volt-ammeter-ohmmeter makes possible a reading of ten times the meter capability.

The Amprobe Deca-tran may be used with any model Amprobe meter. Readings may be taken on round conductors as large as $2\frac{1}{16}$-in. diameter or on bus bar up to ¾ in. x 2½ in. in size. Readings may be taken at the conductor or at a distance of 2 ft. A maximum reading of 1,200 amp may be obtained.
Pyramid Instrument Corp, 630 Merrick Rd, Lynbrook, N. Y.

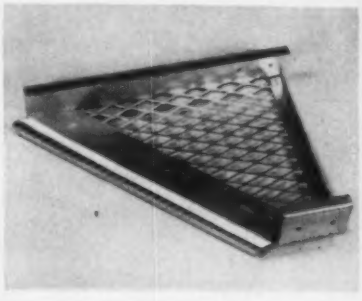


Pressure Device . . .

. . . provides protection for liquid-filled medium transformers. It requires no separate triggering mechanism and resets automatically after a fault. The relief cover is held down by two negative-gradient coil springs. When gas pressure increases to a preset value, the springs buckle and the cover flies open. After initial spring deflection, less and less pressure is required to cause further deflection, thereby opening the cover in minimum time.
General Electric Co, Schenectady 5, N. Y.

Insulating Tape . . .

. . . withstands temperatures up to 500 F. Known as Insul-aid, it is used over compression connectors on ends of mineral-insulated heating cable and other applications where heating is severe. It is available in 1 x 1¼-in. pieces, which fit connectors. The tape can be made in any size for similar applications on 120 or 240-v circuits. It eliminates electrolysis where a possibility of heavy condensation exists.
Apex Sales Co, 765 River St, Paterson, N. J.



Drop-Out Fitting . . .

. . . permits cable to drop out of trays in orderly manner and prevents bunching. Furnished in either right-hand or left-hand models, the fitting eliminates field cutting and assembling of drop-out. Adjustable straight and diagonal drop-outs for center of runs are also available.
P-W Industries, Inc, Duncan & Melrose Sts, Philadelphia 24, Pa.

Molded Caps . . .

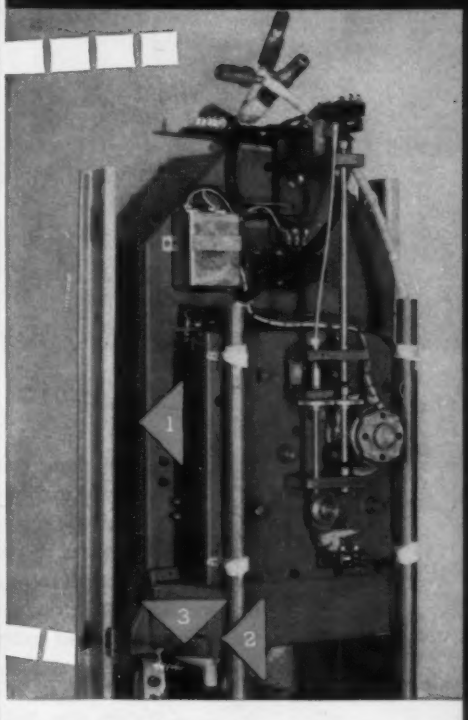
. . . and connectors of PVC are virtually unbreakable. The Royalok heavy-duty caps and connectors, molded of Bakelite QND-5590 polyvinyl chloride, resist acids and oils. The caps are back-wired to eliminate short circuits caused by exposed conductors. Blades are locked in solid vinyl so that nothing can work loose, wobble, or fall out. The entire connector body is molded without eyelets or rivets.
Royal Electric Corp, Pawtucket, R. I.

(More New Equipment on page 54)

Exclusive separate

tap changer compartment

GUARDS SYSTEM LOAD CAPABILITY



The separate tap changer compartment built into your Westinghouse URL or URF regulator is your assurance of peak operating efficiency — now, and *for future loads.* Here are the three basic construction features that provide constant service reliability with minimum maintenance:

1. Felt gasketing keeps carbon out of the main tank and permits equalization of the oil level at all times.
2. Sump collects sediment which is easily, quickly drawn off.
3. Separate external drain facilitates renewal of oil in tap changer compartment.

Only Westinghouse URL and URF regulators (available in sizes 250 kva or below) offer all these bonus values of the separate tap changer compartment for distribution-type regulators. J-70806

YOU CAN BE SURE...IF IT'S

Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS

Are you paying for not having full-load, full-voltage switching on your distribution feeders?

If you are opening your distribution feeders with rotating-insulator disconnects—of the two-insulator side-break or three-insulator vertical-break type—you are already *paying enough* to get full-load switching at full-line voltage (as distinguished from loop sectionalizing . . . load splitting . . . where the voltage across the switch is low).

By using S & C's Side-Break Alduti Load Interrupters, you can have arc-free 600-ampere load switching through 14.4 kv at the same price, or at a lower price than you are now paying. Ordinary disconnects can, at best, only partially handle loop sectionalizing (that is, switching currents in parallel or loop circuits), let alone properly handle full-load, full-voltage switching.

Why do you need this switching capability? There are two important reasons:

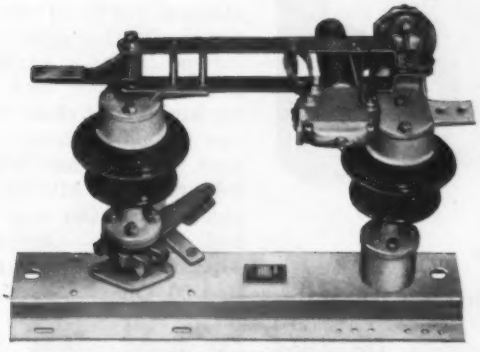
First—Emergency situations (wires down, etc.) demand quick action—dumping the load. And usually there is no time to set up communications for complicated breaker and switch sequencing.

Second—There's always the possibility of switching error, with the result that a loaded circuit may be inadvertently dumped.

If on the other hand, you are using budget-priced rocking or swiveling insulator disconnects, you may be saving on initial costs, but you are still losing the load switching capability you need. With these disconnects, or with rotating insulator disconnects, you will be paying *with trouble*—when you try to drop full load or when you try to open a heavily loaded loop.

S&C

LOAD INTERRUPTERS



Closeup view of S & C Alduti Load Interrupter (side-break style), 14.4 kv rating. May be mounted vertical, upright, or inverted.

For full information about the S & C Alduti (side-break style) and other S & C Load Interrupters, write for Catalog Section 760, S & C Electric Company, 4421 Ravenswood Ave., Chicago 40, Illinois. In Canada: S & C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ont.

S&C

Specialists in High-Voltage Circuit Interruption

Since 1910

Load Interrupters
LOADBUSTER®
Disconnects
Cutouts
Fuse Links
Power Fuses
Metalclad Switchgear

Reader Service

For additional information on new products, supplies, and services in this issue, the Manufacturers Editor of Electrical World offers his facilities. Check items in which you are interested in list below:

NEW EQUIPMENT

Penn Transformer .....Regulators ☐
Rome Cable .....Spacer ☐
L-M .....Enclosures ☐
Pyramid .....Range Extender ☐
GE .....Pressure Device ☐
Apex .....Tape ☐
P-W .....Fitting ☐
Royal .....Caps ☐
Hewson .....Tester ☐
Square D .....Drive ☐
Alpha-Molykote .....Compound ☐

MANUFACTURERS LITERATURE

Code No. .....

(Requests are made from code numbers on page 126).

OTHER

Manufacturers Editor
Electrical World
330 W. 42nd St.
New York 36, N.Y.

* **Note: Requests must be received within four weeks of publication date, accompanied by complete information specified. This service cannot be offered to readers in foreign countries or to competitive manufacturers.**

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FOR:
Reference ..... ☐
Specs ..... ☐
Trial ..... ☐
Purchase ..... ☐

DECEMBER 1, 1958

Insulation Tester . . .

. . . weighs only 85 lb and is small as a man's suitcase. It tests insulation condition of motors, generators, transformers and cables. Powered by selenium rectifiers, the VON tester is available in 50, 100, 150, 200 and 250-kv standard and heavy duty units. The 100-kv tester produces a 5-ma output at 100 kv. **The Hewson Co, Inc, 443 Broad St, Newark 2, N. J.**

Motor Drive . . .

. . . of adjustable voltage anode type features 200 to 1 speed range and ½% speed regulation. The control circuit contains two tubes—one for amplification, the other for voltage regulation. The other circuit elements are static or semiconductor components. The drives are available as standard packages in sizes ranging from ¾ to 40 hp. **Square D Co, 4041 N Richards St, Milwaukee 12, Wisc.**

Wear-In Compound . . .

. . . reduces damage during breaking-in of new machinery. Known as Molykote Wear-In Compound, the material shortens the wear-in period without the use of abrasives. It reduces the galling, seizing and excessive wear during this period. The molybdenum disulfide compound need not be burnished into the surface for maximum effect. **Alpha-Molykote Corp, 65 Harvard Ave, Stamford, Conn.**

More New Products

Folding barricade for use on highway and construction projects is non-collapsible. A bolt-on flasher light is available with 4¼ or 7-in. head or 360-deg dome-type head. The barricade has steel legs and marine plywood cross bars.—Pacific Mercury Co, 14052 Burbank Blvd, Van Nuys, Cal.

Lightweight hydraulic **conduit bender** bends ½ to 3-in. pipe and conduit up to 90 deg with one ram stroke. It is known as No. 883. Designed for operation with either a hydraulic hand pump or hydraulic power pump, the bender is easily moved from job to job.—Greenlee Tool Co, Rockford, Ill.

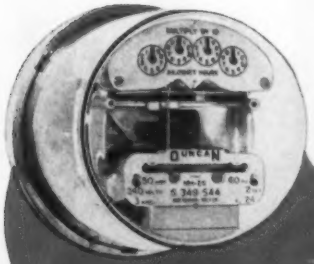
Motor-driven **liquid valve** closes automatically when power fails. Opening and closing is accomplished by a built-in motor with a fail-safe mechanism that closes the valve in case of power failure. The two sizes available are MV-1000 for 3-in. pipe, and MV-2000 for 4-in. pipe. Other sizes may be custom built to order.—Gemco Inc, Box 3908, Shaker Square Station, Cleveland 20, Ohio.

Two-channel **sound distribution system,** called the Consolette (SS 1400 Series), features light annunciators instead of pop-out buttons. Up to 114 stations may be handled on a single system.—Webster Electric Co, Racine, Wisc.

Transfer **volt-ammeter** can be used to check accuracy of laboratory and portable standard instruments. The Hermach-Engelhard Transfer Volt-Ammeter measures alternating voltages and currents in the range of 20 to 20,000 cycles with an accuracy of ±0.05%.—Charles Engelhard, Inc, 850 Passaic Ave, East Newark, N. J.

DUNCAN

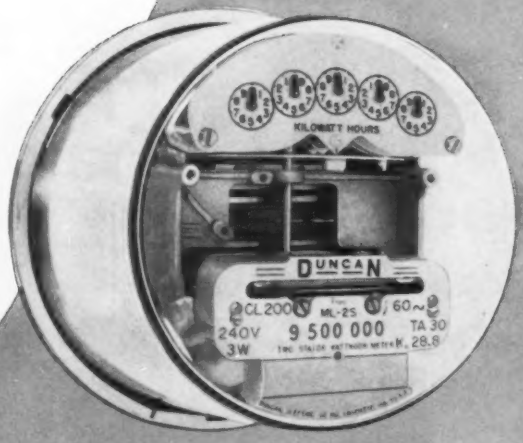
Duncan concentrates on Metering Equipment—the attention of the entire Duncan Organization is devoted to YOUR requirements . . .



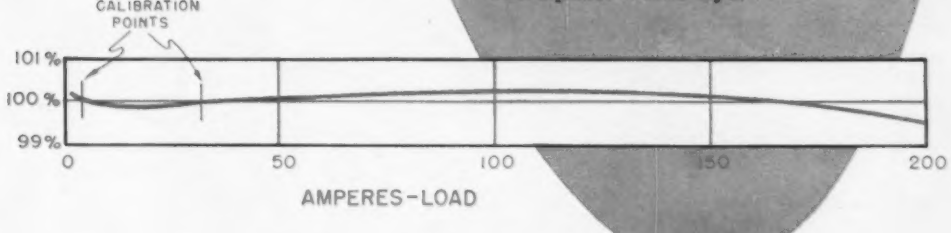
Duncan introduced the first 50-amp. polyphase socket type meters with "extended range" capacity to 200 amperes in 1951.

TODAY

TYPE ML-2S CLASS 200 POLYPHASE



- CLASS 200 Polyphase socket type meters are now available. The new meters, identified as Type ML, are similar to superseded Type MH—previously rated 50-amp. (200 amp. cap.); now rated Class 200-TA30.
- Potential terminal on 5-terminal ML-2S is reversible for use with either 5-terminal or 7-terminal sockets.
- The ML Class 200 is available in 3-phase 3-wire, 3-phase 4-wire delta, and 3-phase 4-wire wye.

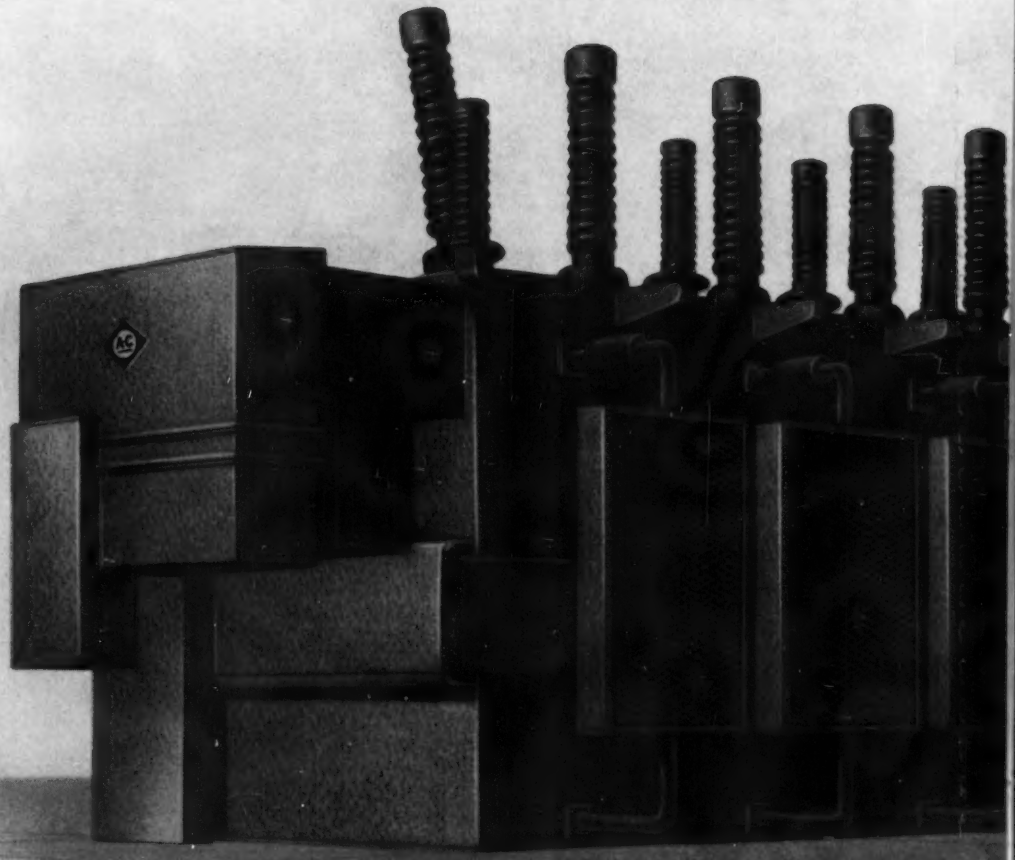


"Designed for the Service"

DUNCAN ELECTRIC COMPANY, INC. LAFAYETTE INDIANA

LIVE BETTER ELECTRICALLY WITH FULL HOUSEPOWER

Another example of



A-C
ALLIS-CHALMERS

A-5865

Allis-Chalmers leadership in transformers

404,250-kva Transformer for Crawford Station

A LARGE three-phase transformer — perhaps the largest — was recently ordered by Commonwealth Edison Company for delivery to Crawford Station in 1960.

The transformer is designed to fit the limited space available between two buildings at Crawford Station. It will also be sized to permit shipment as a complete unit with only bushings and *Electro-Coolers* removed for shipping.

This transformer will weigh about 660,000 pounds and have an equivalent two-winding capacity of 404,250 kva.

Rating of the low voltage winding is 385,000 kva at 12,600 volts. Its two high voltage windings are each rated 211,750 kva and will feed two 138-kva systems. Plus or minus 10 percent load tap changers will be provided for each high voltage winding.

The trend to modernization of power stations is being accelerated by the economies of these larger transformers, as well as bigger generating units.

For further information about the design, building and testing of Allis-Chalmers power transformers, call your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Electro-Coolers is an Allis-Chalmers trademark.

ALLIS-CHALMERS

HEAVY DUTY UNITS include 2 sections of ranges. All equipment is thermostatically controlled

BAKING AREA has 3 sections of electric ovens, 2 of baker's stoves. Separated kitchen areas eliminate cross traffic

Diner Owner Continues to Go All-Electric

T. W. SCULLY, Application Engineer Philadelphia Electric Co, Philadelphia, Pa.

All-electric food service equipment at Christian Zinn's diner-restaurant, Thorndale, Pa., is helping to provide increased dining enjoyment for patrons, and has earned appreciative comment from employees for ease, speed and cleanliness of operation. Of the total connected load of 325 kw, 66% or 214.5 kw is used for electric cooking.

Zinn's also has air conditioning, refrigeration, and ventilation; a public address system; interior, exterior and sign lighting; dishwashing and other food preparation equipment.

Newest addition is an electrically-refrigerated, stainless-steel, pass-through salad server in the short-order section of the kitchen. With this, salads can be prepared in advance of peak hours, and held fresh until served.

Opened in December 1956 on the heavily-travelled Lincoln Highway, 30 miles west of Philadelphia, Zinn's currently employes a staff of 43. The kitchen area is designed for fast-flow food service, and compact styling of the cooking equipment brings step-saving efficiency. Separated sections provide adequate work space, speed food service.

The 3½-acre parking lot surrounding the diner can accommodate 200 cars and is adequately lighted by a combination of mercury-vapor and incandescent floodlights mounted on steel towers. Brightness of the area, and large electric signs, quickly identify the diner to approaching motorists.

Successful diner operation elsewhere prompted Christian Zinn's choice of all-electric equipment at his new location.

"I admit that I'm electric minded," Zinn says. "Previous satisfying experience with electric cooking equipment dictated its use in my new location. Its attractive styling, fast cooking speeds, accurate temperature control, ease, dependability, and cleanliness of operation, all give me what I need for my business: Fast, tasty, convenient, economic food preparation and service. It also make maintenance chores easier, and is an important aid to restaurant sanitation.

And happily, electric cooking has won the same high regard from my chefs and countermen."

Look Awards in Wiring Promotion to be Given for Fifth Time

Awards for outstanding achievement wiring promotion will again be given by Look Magazine. For the 5th consecutive year, awards will go to electrical contractors, utilities and distributors in recognition of the most effective local campaigns aimed at encouraging improvements in the wiring of homes and business establishments.

The competition is divided into four categories: One each for contractors, and distributors, and two for utilities. The awards will be presented at the 15th Annual Wiring Promotion Conference in New Orleans, February 26 and 27, 1959.

Entry blanks from: Alan Waxenberg, Asst. Appliances Market Development Manager, Look Magazine, 488 Madison Ave, N.Y., N.Y.

MUSCLES OF STEEL

The Series PM-2 Pole-Master is shown above on the popular Series 800-C Body. Derrick sizes for handling 40', 55', and 70' poles. Body sizes to fit your job needs.

POWERS-AMERICAN

Pole-Master®

HYDRAULIC DERRICK

Touch a lever, and presto . . . powerful hydraulic cylinders raise Pole-Master from its carrying position and move it to any point within a 190-degree operating arc. Seconds later, you're all set to latch on to the load with the winch line and hoist away! To move the fully-powered Pole-Master under load, just flick the control lever again . . . that's all there is to it.

The detailed story of Pole-Master's many cost-cutting features is yours for the asking. Send for it today!

McCABE-POWERS BODY COMPANY

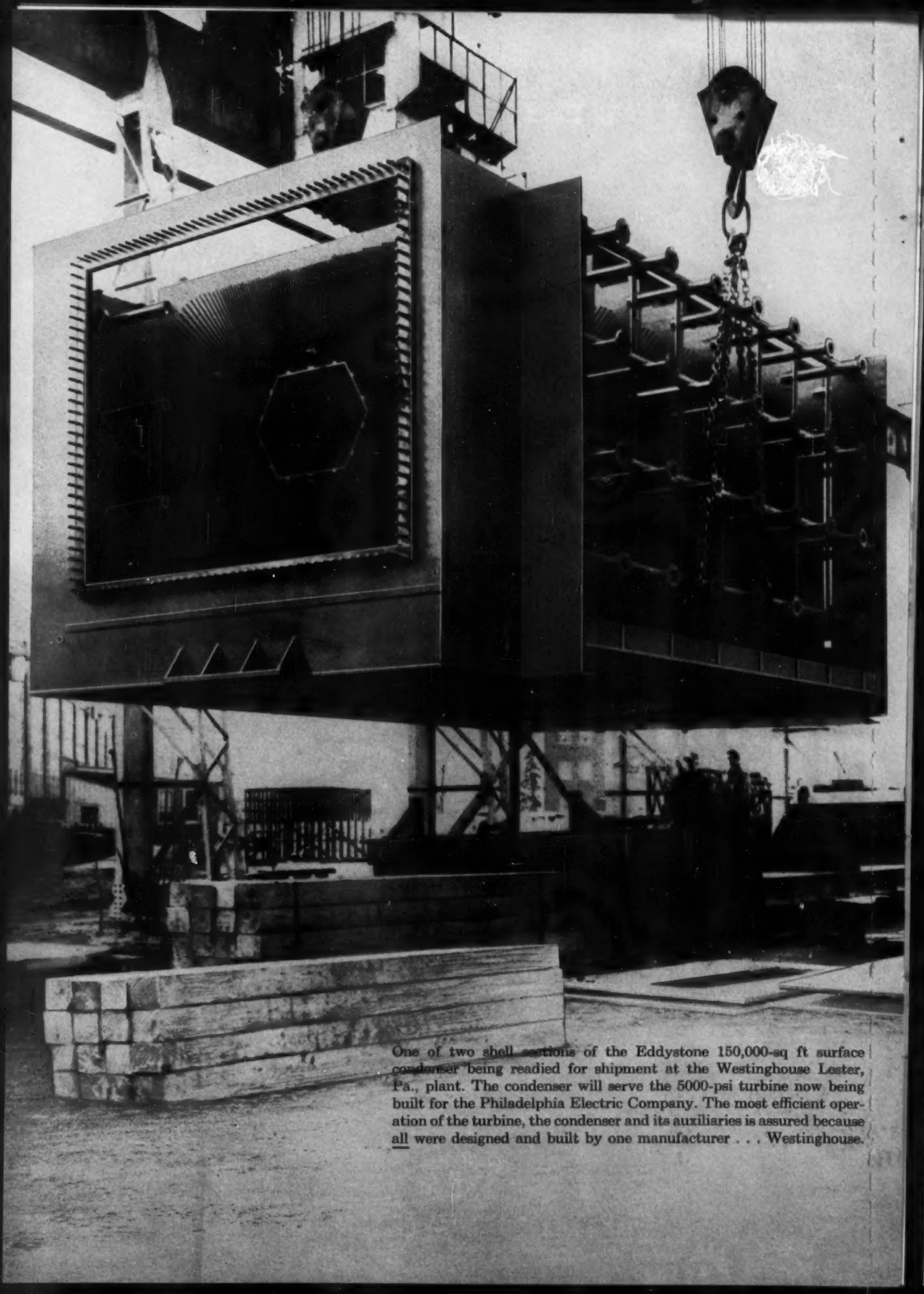
5900 NO. BROADWAY
ST. LOUIS 15, MO.

625 CEDAR STREET
BERKELEY 10, CALIF.

Another reason why
UTILITIES EXPECT MORE FROM
POWERS American
UTILITY BODIES AND EQUIPMENT

EARTH-MASTER HYDRAULIC HOLE DIGGER

Guided auger digs straight, clean holes in practically any soil . . . even frozen ground and hardpan. Digs as deep as 9' 4". Can be used at various angles, too.



One of two shell sections of the Eddystone 150,000-sq ft surface condenser being readied for shipment at the Westinghouse Lester, Pa., plant. The condenser will serve the 5000-psi turbine now being built for the Philadelphia Electric Company. The most efficient operation of the turbine, the condenser and its auxiliaries is assured because all were designed and built by one manufacturer . . . Westinghouse.

New Westinghouse Condenser will help Eddystone 5000-PSI Turbine set world's efficiency record

ANOTHER GIANT STEP has been taken towards the completion of Philadelphia Electric Company's Eddystone station.

Westinghouse has shipped the 150,000-sq ft surface condenser to serve the world's most efficient turbine. Now being built by Westinghouse, the Eddystone turbine will use the highest temperature and pressure steam ever projected...5000 psi at 1200°F.

New Condenser

Because the Eddystone station will use a once-through steam generator, Westinghouse and Philadelphia Electric engineers jointly developed several new features for this surface condenser. *Both of these Westinghouse "firsts" were announced to the industry during the early design stages.*

The detection and location of even *small* leaks are made possible by twenty sampling compartments in the condenser's upper hotwell and collecting trays below the tube sheets. The lower hotwell is divided into three sections, and if any one becomes contaminated, the condensate can be by-passed into a water tank.

Through the second feature, during start-up or in the event of a trip-out or emergency, steam must be diverted from the turbine to the condenser. To protect the condenser from high-pressure and high-temperature steam, this steam is passed through four condenser injection coolers, which act as desuperheaters and pressure reducers.

Fifty Years of "Design Firsts"... Through Plowback of Earnings into Research

The installation of this Westinghouse condenser marks the 50th anniversary of Westinghouse research in designing and building surface condensers. During the past 50 years, Westinghouse has developed many of the *basic* condenser designs that today help the industry to produce low-cost electricity. Westinghouse "design firsts" include radial-flow, air ejectors, steel diaphragms for tube expansion, vertical propeller pumps and reverse flow valves.

Because of its vast and continuing research projects, Westinghouse has been traditionally *first* with design improvements. That's why it pays to specify Westinghouse. *You get today... the surface condenser of tomorrow.*

For complete information, contact your Westinghouse representative, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-50608

Research developments now underway

Through Plowback of Earnings into research, Westinghouse is pioneering many condenser developments that will do much to help the industry meet future loads with low-cost electricity. Following are a few of the projects that are underway in the $6,000,000 Westinghouse Steam Development Laboratory

Lower costs for foundations

Westinghouse research and development engineers are exploring new structural designs that promise to slash the weight and size of surface condensers and result in lower costs for foundations.

Dropwise condensation for improved heat transfer

If tube surface were nonwettable, steam would condense as droplets, rather than as a heat-barrier film. Westinghouse is searching for the water repellent that will keep the tubes nonwettable *throughout the life of the condenser*. This research project will result in improved heat transfer rates . . . and permit a great reduction in the size, weight and cost of condensers.

Reduction of aerodynamic losses

Westinghouse engineers are probing all the interrelated causes of aerodynamic losses in the transition section between the turbine and the condenser. These studies, made in cooperation with the turbine department, are leading to design changes that will give the industry condensers that are not only smaller, but more efficient.

Greater velocity for increased efficiency

The greater the water velocity, the better the heat transfer rate. Also true — the greater the velocity, the shorter the life of the tubes. In the Westinghouse Steam Development Laboratory, engineers are busy studying ways to prolong the life of tubes subjected to water velocities greater than the present seven to eight feet per second.

YOU CAN BE SURE...IF IT'S **Westinghouse**

Here's how Roebling VCV works!

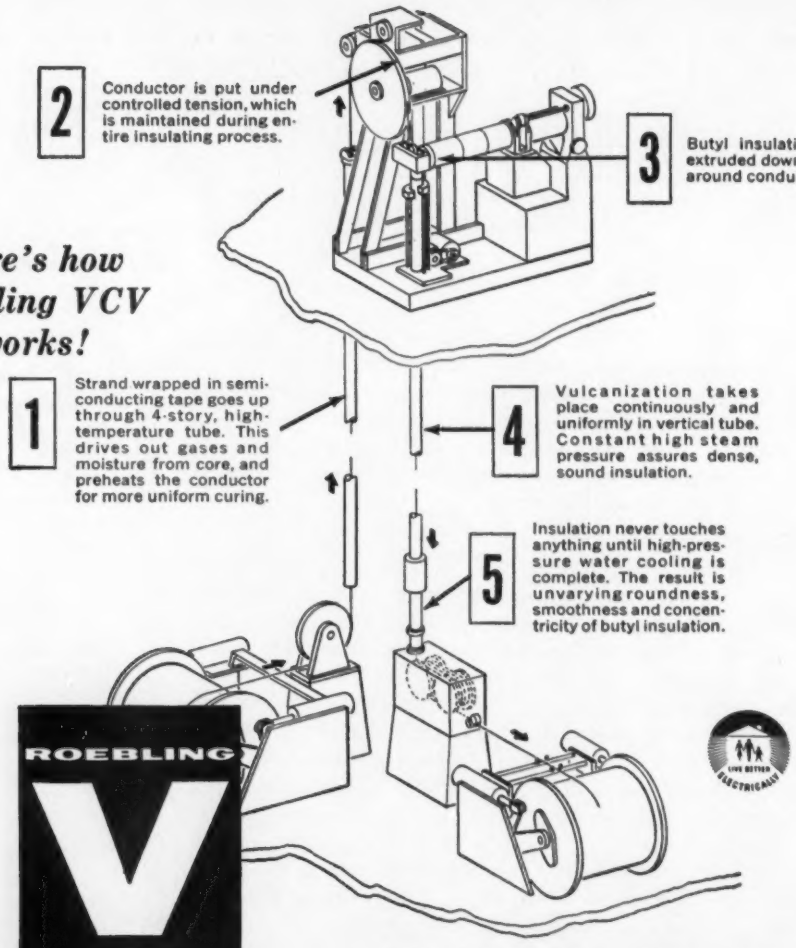
1 Strand wrapped in semi-conducting tape goes up through 4-story, high-temperature tube. This drives out gases and moisture from core, and preheats the conductor for more uniform curing.

2 Conductor is put under controlled tension, which is maintained during entire insulating process.

3 Butyl insulation is extruded downward around conductor.

4 Vulcanization takes place continuously and uniformly in vertical tube. Constant high steam pressure assures dense, sound insulation.

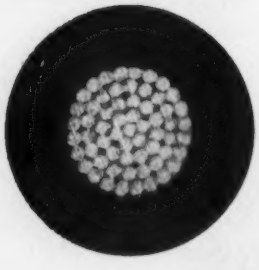
5 Insulation never touches anything until high-pressure water cooling is complete. The result is unvarying roundness, smoothness and concentricity of butyl insulation.



The Conductor is Always Dead Center

ROEBLING

VCV



ROEBLING'S 15 KV CABLE HAS UNIFORMLY HIGH CORONA LEVEL AND DIELECTRIC STRENGTH. VERTICAL CONTINUOUS VULCANIZATION ASSURES UNUSUALLY LONG TROUBLE-FREE CABLE SERVICE.

If you sliced a length of Roebling's VCV 15 kv Cable into cross sections, you'd find that *every inch* is uniform, every inch is round, and in every inch the conductor is exactly centered!

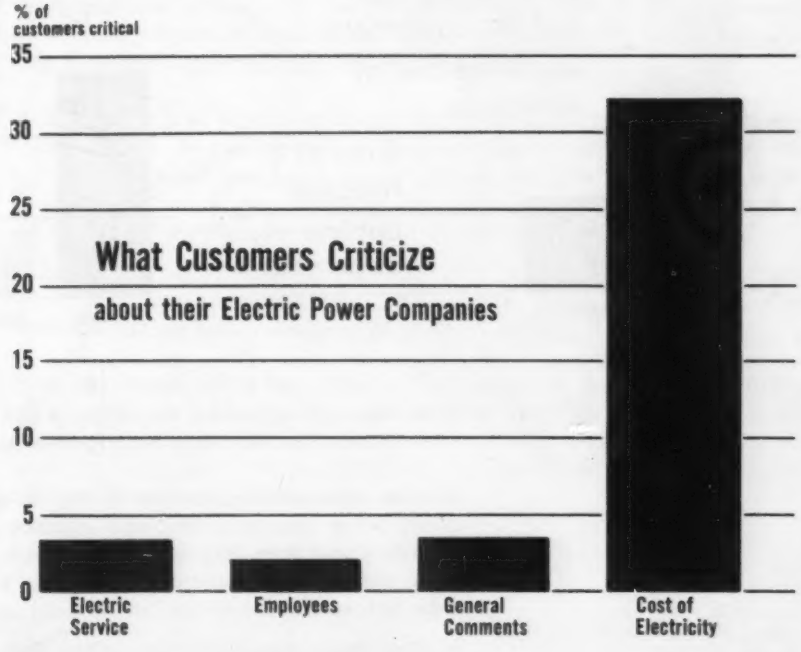
VCV is responsible for the exceptional quality of this new high-voltage cable. No longer will you buy cables in which the conductor has "snaked," or that has flattened, scraped, blistered or abraided insulation. Because insulation is the same thickness and density for the length of the cable, dielectric strength and corona level are uniformly high.

ROEBLING VCV 15 kv CABLES are available in a complete range of conductor sizes and insulation thicknesses

Write today for more facts about the longer, better service you'll get with Roebling VCV High-Voltage Cable. Electrical Wire Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation



According to Central Surveys . . .

Rates Are Key to Public Opinion

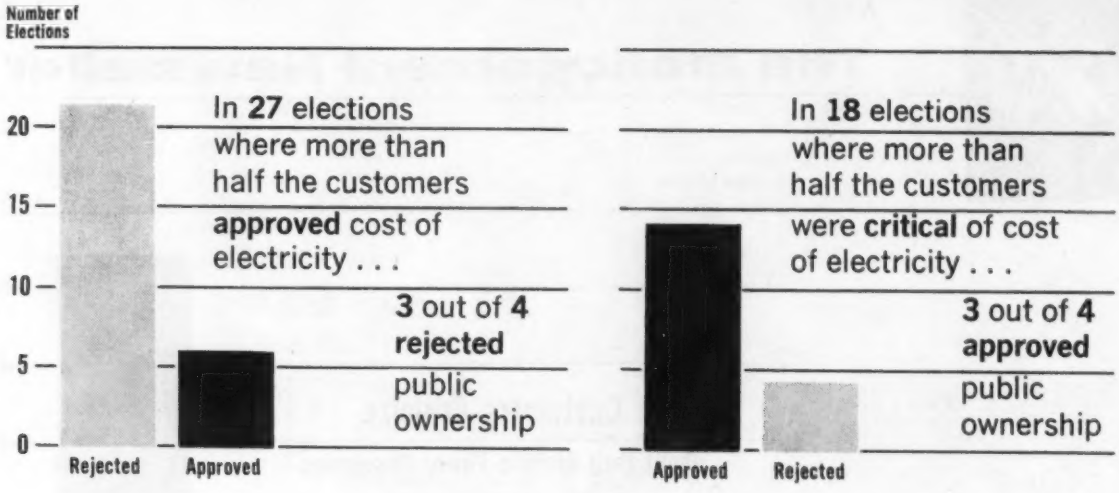
Public Relations

Your customer's opinion of your electric rates may be the most important molder of his opinion of your company, and there is convincing evidence that his opinions on rates may even determine his position on the whole issue of public ownership of electric utilities. William M. Longman, executive vice president of Central Surveys, Inc, made this point at the recent Ebasco Annual Client Companies' Sales and Public Relations Workshop. He emphasized that it is the customer's opinion of the cost of electricity, and not the cost itself, that is important in molding public opinion. In fact, Central Surveys found a wide spread of opinion on rates among towns billed under the same schedule.

Longman also went on to map out current trends in public opinion affecting the utilities and to explain what his company's research indicated might be the best way to improve utility public relations.

Central Surveys has found that many more people are critical of rates than they are of anything else about an electric company. On the average, one person in three is critical of the cost of electricity. In comparison, only an average of one customer in every 25 or 30 or 40 is critical of the service, employees, or general conduct of his electric company.

Attitudes on cost are closely related to attitudes on public ownership. By surveying about 5,000 customers in 45 widely-scattered cities and towns, Central Surveys found that the customers who approve the cost of electricity oppose city ownership by 53% to 16%, a ratio of better than three to one. On the other hand, customers who say that the cost of electricity is too high divide almost


Number of Elections
20
15
10
5
0
In 27 elections where more than half the customers approved cost of electricity . . .
3 out of 4 rejected public ownership
Rejected
Approved
In 18 elections where more than half the customers were critical of cost of electricity . . .
3 out of 4 approved public ownership
Approved
Rejected

evenly between support for the company and support for city ownership. In some communities, the relationship is even closer.

An even more striking example of this tie-in is provided by surveys made shortly before municipal ownership elections in 45 towns. In 21 of the 27 elections where more than half the customers approved the cost of electricity, public ownership was defeated. But in the 18 elections where fewer than half of the customers approved the cost of electricity, public ownership carried in 14.

In other words, experience has shown that public ownership agitation will succeed in three out of four cases if the criticism of the cost of electricity is high enough; but in elections where at least half the voters are satisfied with the cost, there are three chances out of four that public ownership will be defeated.

Opinions seem to be worsening as inflation forces electric rates upward. Between 1950 and 1956, the percentage critical of the cost of electricity has gone from 26% up to 32% critical—a relative increase of about 23%. Longman made the point that this increase in criticism took place while the kwhr rate for the typical residential consumer was increasing by only about 4%, but that the actual size of the customer's bill had risen about 50% during the period, owing to the addition of new appliances.

Criticism is increasing fastest in the more influential groups, Central Surveys has found. Surveys of the customers of one power company taken in 1957 and 1958 showed that criticism of the cost of electricity among the entire group had increased by 2%. But 13% more customers in the highest income bracket were critical, and 15% more business and professional people voiced their disapproval.

There is a tendency for criticism to increase during recessions, and this may explain the current bulge. During 1953-1954, the percentage of customers who expressed criticism of the cost of electricity jumped from 28% to 32%. Most of this loss was regained during the boom period that followed, but with the recent recession, the trend of criticism again turned upward. During the last half of 1957, 30% of the customers questioned by Central Surveys expressed disapproval of cost. In the first half of this year, the proportion rose to 33%.

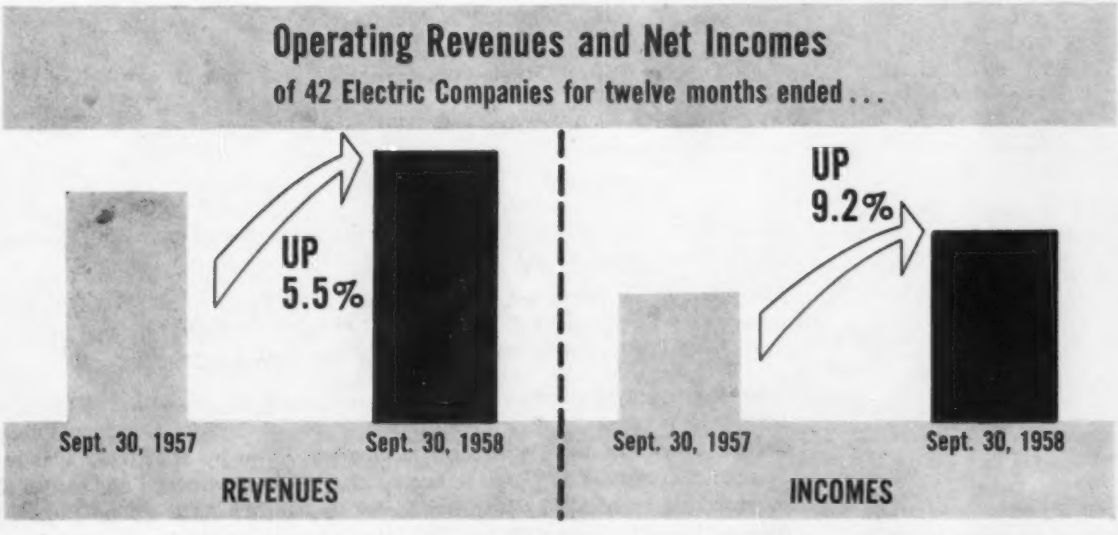
What can power companies do to reduce customer criticism? Longman said that advertising could be an effective tool, and called attention particularly to the testimonial type advertisement. Before-and-after surveys in one area where such ads were used showed that criticism of the cost of electricity had dropped

as much as 20% in some communities, and an average of about 10% for the entire area in which the advertisements had been run. He also cited advertising on the "value" theme of Live Better—Electrically, mentioning specifically the check list of electrical appliances, which calls attention to the fact that the number of appliances (and the size of your electric bill) are an index of your family standard of living. He also praised the "supermarket" ad used recently by Wisconsin Power & Light Co (EW, Aug. 11, 1958, p 78) to stress the low cost, in pennies, of doing things with electricity.

A basic need is to educate customers regarding increased use of appliances, Longman said. In one survey, his company asked people how many electric appliances they had, and found that the average family thought they had eight. In an actual count, it was determined that these same homes had an average of 14 appliances—nearly twice as many as the customers realized they had.

In another survey, customers were asked which appliances they felt were most likely to run up their electric bills. Many laid the blame on their irons, while television and air conditioning tended to be taken for granted.

Longman complimented the utilities on the reputation for service which they have built up, and also on the high esteem in which the public holds utility employees. He said that his emphasis on cost attitudes was not intended to run down the importance of such other factors, but that the utilities seemed to have these problems well under control.



Revenues, Net Incomes Up in 42-Utility Sample

Utility Earnings

The first 42 utility earnings reports to reach EW show net incomes rose 9.2% for the twelve months ended Sept. 30 over the comparable period last year. Net incomes for these 42 companies (before all dividends) topped $479 million in the period ended Sept. 30, 1958. In the year ended Sept. 30, 1957, the same utilities had reported a net of $438 million.

Operating revenues, meanwhile, moved up 5.5%. Combined revenues of the 42 companies totaled $3.2 billion in the 1958 period, compared with $3.1

Net Incomes of 42 Electric Utilities

for the 12 months ended Sept. 30, 1958 and Sept. 30, 1957

COMPANY	1957 Thousands	1958 Thousands	Change %	COMPANY	1957 Thousands	1958 Thousands	Change %
Arkansas-Missouri Power	$ 1,180	$ 1,209	2.5	Philadelphia Electric	36,027	39,259	9.0
Atlantic City Electric	5,034	5,559	10.4	Portland General Electric	5,605	6,060	8.1
Baltimore Gas & Electric	17,133	17,310	1.0	Potomac Electric Power	10,199	10,315	1.1
California Electric Power	4,299	4,713	9.6	Public Service of Colorado	10,904	10,071	—7.6
California-Pacific Utilities	744	817	9.7	Public Service of Indiana	14,870	15,779	6.1
Central Illinois Electric & Gas	3,140	3,293	4.8	Public Service of New Mex.	2,281	2,713	18.9
Central Power & Light	8,822	9,412	6.7	Public Service of Oklahoma	8,159	8,484	4.0
Central Vermont P S	1,239	1,603	29.4	San Diego Gas & Electric	6,554	6,411	—2.2
Commonwealth Edison	52,979	58,826	11.0	Savannah Electric & Power	1,654	1,986	20.1
Consolidated Edison of N. Y.	55,017	63,493	15.4	South Carolina E & G	6,344	8,350	31.6
Dallas Power & Light	8,048	9,011	12.0	Southern Indiana G & E	2,686	2,876	7.1
Delaware Power & Light	7,132	7,281	2.1	Southern Nevada Power	1,037	961	—7.3
Duquesne Light	20,203	21,240	5.1	Southwestern Electric Power	6,137	6,605	7.6
El Paso Electric	2,923	3,306	13.1	Texas Electric Service	14,819	15,887	7.2
Idaho Power	6,015	8,210	36.5	Texas Power & Light	12,413	13,544	9.1
Interstate Power	3,353	3,947	17.7	Tucson Gas, Electric L & P	2,358	2,824	19.8
Iowa-Illinois Gas & Electric	5,350	5,330	—0.4	Utah Power & Light*	8,407	8,588	2.2
Long Island Lighting	12,533	14,329	14.3	Western Light & Telephone	1,838	1,756	—4.7
Montana-Dakota Utilities	3,655	3,970	8.6	Wisconsin Public Service	5,432	5,622	3.5
New York State E & G	11,758	13,848	17.8				
Niagara Mohawk Power	25,596	30,315	18.4	**Total—42 companies**	**$438,206**	**478,639**	**9.2**
Northwestern Public Service	971	1,103	13.5				
Pennsylvania Power & Light	23,356	22,423	—4.0				

*Includes Telluride Power Co from May 1, 1958

billion for the year-earlier period. All 42 companies showed increases in operating revenues over the 1957 period.

The table above shows net incomes of the 42 utilities, with the year-to-year change given in percent. Of the 42, only six companies showed percent declines over the period. The other 36 companies posted gains of from 1% to 36.5%.

Interest charged to construction figured prominently in the largest changes at both ends of the scale. The largest reported percent decline came from Public Service Co of Colorado, where net income was down by $833,699. This reflected a reduction of $567,360 in interest charged to construction and increased interest charges of $857,675. And Idaho Power Co's $2.2 million (36.5%) increase in net includes a $2.4-million hike in interest charged to construction.

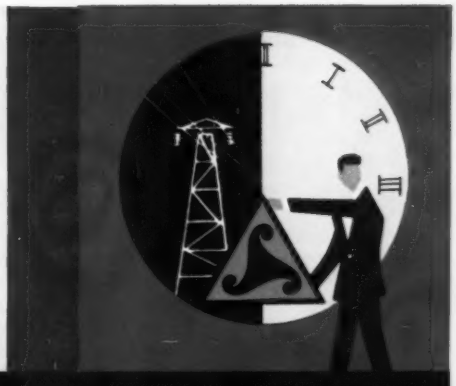
Southern Nevada Power Co, whose net declined by $76,193, cut its interest to construction credit by $327,000—from more than $341,000 to about $14,000. Southern Nevada's operating revenues showed a 16% rise.

Net income of **South Carolina Electric & Gas Co** rose by about $2 million, partly by virtue of a 10% revenue rise with only an 8% increase in total operating revenue deductions. Almost $1 million of the increase, however, was due to an increase in the interest charged to construction credit.

Other notes from the income statements: By cutting operating expenses while raising revenues, **Central Vermont Public Service Co** chalked up a 29.4% gain in net . . . **Pennsylvania Power & Light Co** attributes its loss in net (amounting to 7¢ per common share) to damage inflicted by the March snowstorm.

Satisfaction at Salem

New unit "On Schedule" for New England Electric



Unit #3 of New England Power Company's* Salem Harbor Station recently went "on the line" on schedule. In a highly successful demonstration of working together in close cooperation, Stone & Webster Engineering Corporation and New England Power Company jointly designed this new 125,000 kw unit. Stone & Webster supervised the construction of this latest unit which makes the complete Salem installation the largest electric power station in the great New England Electric System.

**Part of New England Electric System*

On every project . . . of whatever size and wherever located . . . Stone & Webster engineers keep construction schedules and cost estimates constantly in mind. If you would like to discuss how Stone & Webster's broad engineering and construction experience can help you on your next project, call or write our nearest office.

Stone & Webster builds installation and operating savings into your project through engineering economies and extra plant efficiency.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

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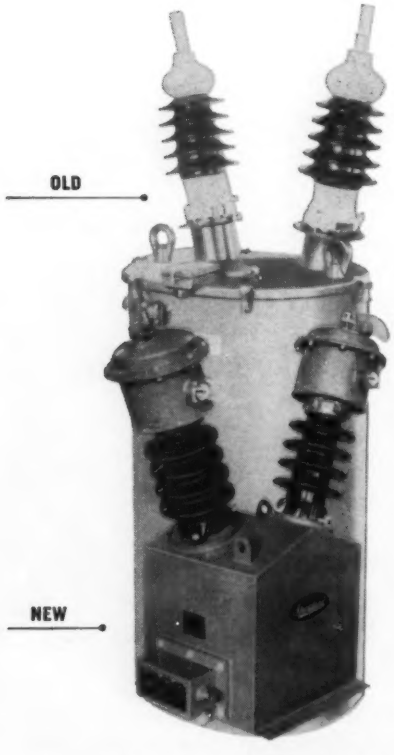
OUTDOOR METERING TRANSFORMERS...

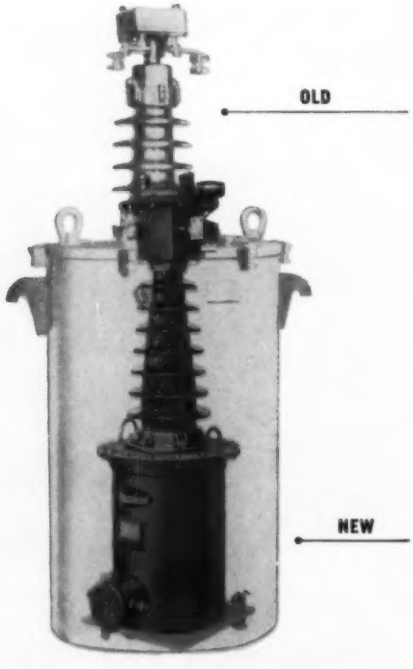
...accuracies within 0.3% at all ASA standard burdens

Standard Transformer's new line of completely redesigned outdoor metering transformers gives maximum accuracy on all metering applications. The vacuum impregnating process removes all traces of air from the heated core and assembly, resulting in the highest dielectric strengths. The new line conforms to all ASA, EEI and NEMA mounting and accuracy standards. These transformers are smaller and lighter than ever before. For specifications and certified dimension prints, see your nearby Standard Representative or write directly to us. You'll increase your accuracy where it counts most—ahead of and at the meter.



TYPE PXO OISC POTENTIAL TRANSFORMER

—outdoor type. Up to 69,000 volts primary; 120 volts secondary and secondary terminal box. Also available with single bushing for line to ground connection.



TYPE CWO OISC CURRENT TRANSFORMER

—outdoor type. Up to 69,000 volts; and up to 400/800 to 5 amperes. With oil level indicator, primary bypass protector, and secondary terminal box.

LIVE BETTER ELECTRICALLY

Phone 2-1563

Standard Transformer CO.

WARREN, OHIO

"WHEREVER THERE IS POWER"

Tighter Licensing Proposed for Existing Dams

Kuykendall wants amortization reserves set up at time of license plus penalties for unlicensed dam operators

Chairman Jerome Kuykendall of the FPC has made two suggestions for tightening the commission's initial licensing procedures for previously constructed hydro power projects to the House Legislative Oversight Subcommittee.

He insists that the two "possible statutory amendments" to the Federal Power Act for subcommittee "consideration" only, and do not constitute "recommendations for legislative action." However, Kuykendall's comments on the complicated FPC 50-year licensing procedures were requested by subcommittee Chairman Oren Harris during a September hearing, and Harris may use them as the basis for proposed legislation in the next Congress (EW, Oct. 6, p 64).

Suggests Early Amortization

One of Kuykendall's proposals would require the operator of a newly-licensed power dam, which has been operating for 20 years, to establish an amortization reserve at the time of the license, rather than 20 years later. The other proposal would penalize the operators of unlicensed dams who do not apply for initial licenses within a year from the enactment of such a law. Kuykendall's proposals, in detail, are as follows:

1. Amend Section 10 (d) of the Federal Power Act, "so that in initial licenses for constructed projects, operated for 20 years or more without requisite federal authority, the amortization reserve shall be started with the effective date of the license."

Subcommittee Counsel Francis McLaughlin testified at the September hearing that the present law—requiring the reserve to be started only after 20 years of operation under license—has the effect of penalizing licensed projects in contrast to unlicensed projects, where establishment of the reserve can be effectively delayed until 20 years after a license is required by FPC action.

Kuykendall pointed out that this amendment would involve complications.

He said that determination of a reserve (from profits in excess of a "reasonable return") would have "little practical effect" on industrial licenses, where there is no return because there is no actual sale of power. Earnings by private power projects, however, would be easy to determine, he added.

2. Amend Section 23 (b), "providing that if application for license is made for any unlicensed project, subject to the licensing provisions of Section 4 (e), within one year from the effective date of this amendment, the commission may issue a license for a period of 50 years from the date of the application . . . but that if application for license is filed hereunder more than one year from the effective date of this amendment, the commission may not issue a license for a term extending beyond June 30, 1970, for a constructed project, subject to its licensing jurisdiction and previously unauthorized, if the project was constructed prior to June 1, 1920, or for a term extending more than 50 years beyond the date of construction, if constructed after June 1, 1920."

Kuykendall emphasized that this proposal should in no way restrict the commission's right to issue licenses up to 50 years in term, if the license is for a constructed project being operated without federal authority, "and included therewith are proposed new project works at an undeveloped site necessary or desirable to bring the combined constructed and proposed projects within the terms of Section 10 (a) of the act, or a previously unauthorized project is to be modified to bring it within the terms of that section."

'Package' Licenses a Boon

The FPC chairman added that "one of the primary, basic purposes" of the FPC licensing procedure is to secure "the best and most comprehensive development and complete utilization of water power resources obtainable in harmony with other beneficial public uses." He said the FPC has best been able to carry out comprehensive development through the use of "package" license applications, where one or more existing projects are placed under the 50-year initial license of a new power development, directly related to the existing projects.

British Plan 650-Mw Nuclear Plant

A big addition to Britain's ambitious nuclear power program was announced in October on the second anniversary of Calder Hall dedication ceremonies. The Central Electricity Generating Board revealed plans for a 650-Mw nuclear station on the Suffolk coast in East England.

To be known as the Sizewell station, the proposed plant would have an advanced gas-cooled reactor fueled, probably, with sintered uranium oxide. Fuel elements would be sheathed in beryllium instead of magnesium.

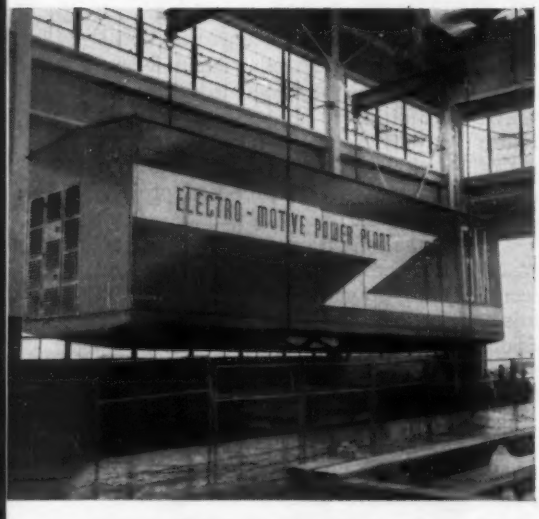
Meanwhile The Financial Times reported that an addition to Britain's Hinkley Point station may achieve a total output of between 1,300 to 1,500 Mw by 1966, instead of the presently planned 500 Mw.

Other reactor systems under study for possible use in the 1970's are the high-temperature gas-cooled reactor which would use a mixture of graphite, uranium and thorium as a fuel element, the heavy-water moderated gas cooled reactor, and the fast breeder reactor.

Britain has about 3,490 Mw of nuclear capacity on the line, under construction or planned. By the 1970's it is expected that she will be producing at least half her electrical requirements in atomic plants.

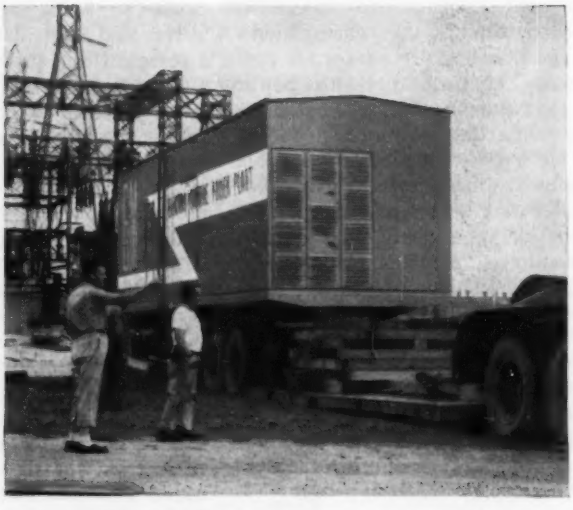
Factors speeding her progress include better steel welding, larger cores and improved fuel elements.

6000 KW PEAKING PLANT



FIRST DAY

First of three self-housed generators is placed on flat-bed trailer or rail car at Electro-Motive Plant. Unit is then hauled to installation site.

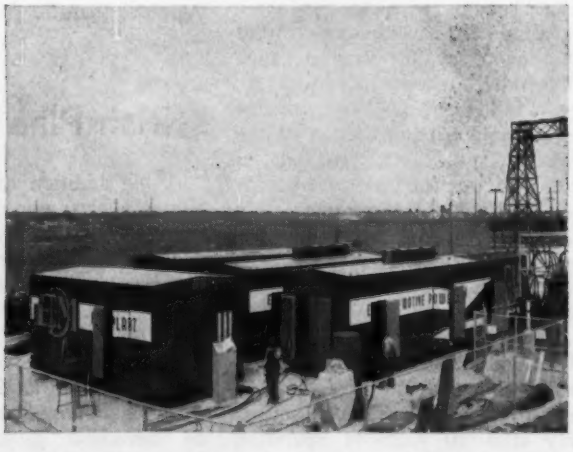


THIRD DAY

First generator arrives at site. Previously, underground fuel tanks, lines, cables were installed, ground leveled and stone fill added. Ties were then placed on fill to form foundations for plant components.

SIXTH DAY

Third generator arrives at site. Controls component and second generator were installed day before. "Package" design of all components permits easy handling with winch and jacks.



EIGHTH DAY

Adjustment and inspection. Performance tests on individual components begin. On ninth day, plant is checked out under actual load conditions, integrated into system operations. Safety fence completed.

ON THE LINE IN TEN DAYS

TENTH DAY

6000 KW of new peaking and reserve power is put on the line. Landscaping was added later to complete site. Plant operates completely unattended, comes up to full load from dead start in less than ninety seconds. Entire plant could be moved to new site in same ten-day period, if changing load characteristics require such a move. For complete details, contact your Electro-Motive representative.

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS · La Grange, Ill.

Sales-engineering offices:
Chicago, New York, St. Louis, San Francisco

In Canada:
General Motors Diesel Limited, London, Ontario

GSU Announces Executive Changes

Gulf States Utilities Co has elected a vice president and announces new duties for two other executives. Eldon A. Werner, personnel manager, has been named vice president. John J. Morrison, executive vice president and director, has been assigned duties involved in the general operation of the utility's system. Ralph E. Cargill, vice president in charge of engineering, transmission and distribution assumes power production responsibility.

WERNER

MORRISON

CARGILL

Werner joined Gulf States in 1941 in the personnel department, and was appoined its manager in 1945. Morrison joined the company in 1947 as assistant to the president, and became a vice president in 1954. Cargill became vice president in 1955.

The company also appointed Robert W. Jackson an assistant secretary. He joined Gulf States' corporation department in 1955.

Bobo, Knudson Promoted at Federal Pacific Electric Co

BOBO

Federal Pacific Electric Co has elected Robert L. Bobo vice president-marketing and Harry E. Knudson, Jr., general sales manager. Previously Bobo had been general sales manager and Knudson manager of the Middle Atlantic sales region.

Bobo will direct both field selling and headquarters marketing activities. He joined Federal Pacific in 1954 as manager of the Great Lakes sales region, later taking over management of the company's Cleveland manufacturing plant.

Knudson joined Federal Pacific in 1946 as a sales specialist in the firm's Harrisburg, Pa., office. He later served as Philadelphia district manager and manager of the combined Philadelphia and Newark, N. J., sales districts.

KNUDSON

Glenn Mitchell Becomes President of Southern States

G. MITCHELL

RICHARDSON

W. C. MITCHELL

Three managerial changes have been announced by Southern States Equipment Corp effective December 1. Olan Richardson, president, has been elected chairman of the board. Glenn Mitchell, former vice president-manufacturing, will be president. W. C. Mitchell, vice president and treasurer, will be executive vice president.

Glenn Mitchell has been with Southern States since 1937 in production and manufacturing capacities. Richardson joined the company in 1939 as chief engineer, and has been president for 18 years. W. C. Mitchell began with the company in 1940 as purchasing agent, and became vice president and treasurer in 1945.

THIS MAN CAN ADD TO YOUR PROFIT PICTURE. This is a Dowell service engineer—on the job. His knowledge and abilities in chemical cleaning can help you to greater profits. Recently, an eastern corporation used Dowell Service for its boiler cleaning maintenance. Dowell's service engineer studied the problem, did the job. His use of chemical solvents in cleaning tubes and other metal surfaces was effective. On the basis of Dowell Service, this company will realize improved profits of $440,000.

There are three ways you can clean your plant equipment: *Mechanically* with your own crews—inefficient, time consuming and expensive in today's industrial pace. *Chemically* with your own crews—again inefficient and unprofitable because of heavy payroll and the personnel's lack of qualification. Or with *Dowell Service,* the modern chemical cleaning method.

With Dowell Service you receive the benefits of more than fifteen years experience in chemical cleaning—plus special equipment, chemicals, research and trained personnel. You pay one charge, get an efficient job, handled by knowledgeable people.

Every industry can profit from Dowell Service. Ask your maintenance and operating engineers if they have thoroughly investigated the profit possibilities of using Dowell Service. DOWELL—A SERVICE DIVISION OF THE DOW CHEMICAL COMPANY. Headquarters and research center, Tulsa, Oklahoma; 165 offices and stations to serve you.

Chemical cleaning service for industry DOWELL

CUSTOM CUSTOM

Answers to operating problems:

SYSTEM GROWTH

PROBLEM: On many systems where manual dispatching is still used, the increasing complexity of loading problems will shortly require some form of automatic execution, although a comprehensive computer-control may not be needed for several years. Operators on these systems ask how they can get automatic generation control which is simple to operate, and thereby enable personnel to make the transition to automatic operation smoothly.

SOLUTION: Installation of an L&N custom control designed specifically for the particular operating problem at hand. A wide range of proved L&N control components makes it possible to select the control approach that provides an optimum combination of operating simplicity, minimum generation changes, and lowest costs at the coal pile.

Another advantage: You can add a computer to your control at any future time without obsoleting installed equipment.

Study the complete story and you'll see why more than 70 utilities—and some 60,000,000 KW—operate with L&N custom controls. Contact your nearby L&N Field Office, or 4938 Stenton Ave., Philadelphia 44, Pa.

LEEDS & NORTHRUP
Instruments — Automatic Controls • Furnaces

Louzecky Gets New Post at Nordberg

Nordberg Manufacturing Co has made Paul J. Louzecky chief engineer of its engine division.

Louzecky began his career as a mechanical engineer for Electric Products Co, advancing to assistant chief draftsman. Two years later he became research laboratory assistant for the Weatherhead Co. In 1935, he joined the Cleveland engine division of General Motors. He was chief technical engineer for the division from 1955 until joining Nordberg.

Indiana Steel & Wire Promotes Barb

Earl C. Barb has been made manager of sales, electrical materials, by the Indiana Steel & Wire Co, Muncie, Ind.

He will direct sales of the company's galvanized steel strand, preformed armor rods and associated items.

PERSONAL BRIEFS

Central Maine Power Co has named **N. W. Wilson** secretary and general counsel to succeed **E. H. Maxcy,** who continues as director and vice president.

California Electric Power Co has appointed **F. E. Lucking** commercial manager. **James G. Hart** has been appointed assistant commercial manager and will serve in that capacity with the present assistant commercial manager, **Wilks Lambirth.**

William J. Olson retired after 41 years in the Operating Division of the Seattle City Light Co.

The Connecticut Light & Power Co has promoted **Wilbur B. Couch** to the newly created post of Security Coordinator, and **George W. Russell** to local manager at Niantic.

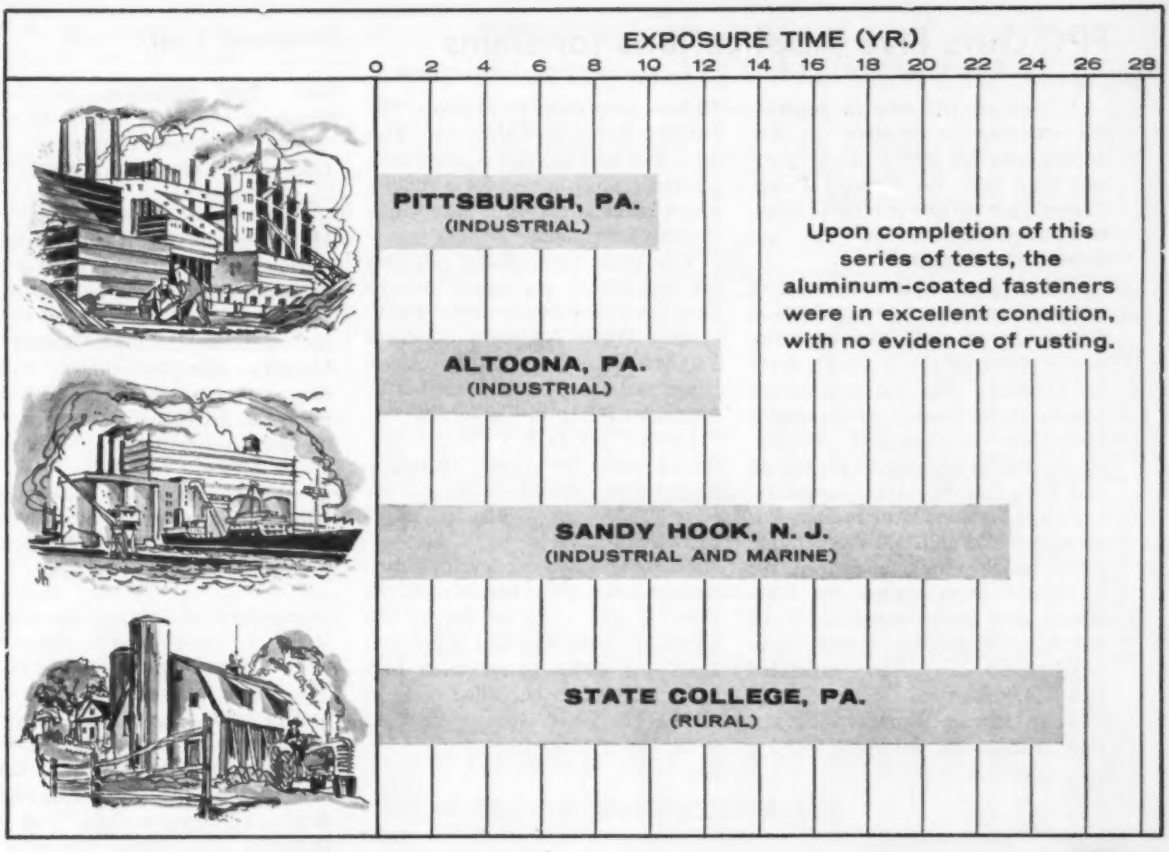
Duke Power Co has named **Martin L. Frick, Jr,** to the distribution engineering staff in its Charlotte office.

Virginia Electric & Power Co has named **Clarence H. Rainey** district accountant at its Fredericksburg office.

Ernest F. Walsh, superintendent of production, Narragansett Electric Co, has been appointed engineer of steam plant operations for New England Electric System with headquarters at Boston. **Walter G. Weitzel,** assistant superintendent at Providence, succeeds to Walsh's former post. **Harry L. Hurd,** operating assistant of NEES becomes superintendent of the system's Western Division with headquarters at Shelburne Falls, Mass. He replaces **Henry A. Suprenant** who retired. **Allen M. Herrmann** of NEES's purchasing department has been named assistant to the manager of Granite State Electric Co.

Westinghouse Electric Corp has made **Kenneth J. Culp** manager of marketing for the atomic fuel department.

The Illinois Municipal Utilities Assn has named the following new officers: **Earl Wiker,** Rantoul, presi-


EXPOSURE TIME (YR.)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28
PITTSBURGH, PA.
(INDUSTRIAL)
ALTOONA, PA.
(INDUSTRIAL)
SANDY HOOK, N. J.
(INDUSTRIAL AND MARINE)
STATE COLLEGE, PA.
(RURAL)
Upon completion of this series of tests, the aluminum-coated fasteners were in excellent condition, with no evidence of rusting.

ASTM Atmospheric Corrosion Tests Prove Durability of Aluminum Coatings

In atmospheric corrosion tests conducted by the American Society for Testing Materials, steel articles coated with hot-dip aluminum, and others with different coatings, underwent close scrutiny in industrial, marine, and rural areas. In some locations, the aluminum-coated articles were exposed for more than 20 years, yet no evidence of rusting was noticed. On the other hand, competitive coatings had either completely or partially deteriorated.

Based upon these ASTM studies, it is reasonable to assume that fasteners coated with Bethalume, Bethlehem's coating of virtually pure aluminum, will more than prove their worth when exposed in transmission towers and other types of structures.

The Bethalume coating is applied by immersing the fasteners in molten aluminum, after which they are carefully processed to insure clean threads and satisfactory thread fit. The Bethalume coating is composed of two layers—an outer layer of pure aluminum and an iron-aluminum alloy bonding layer. This tight metallurgical bond is similar to that obtained in other hot-dip coating processes. What's more, the coated bolt threads are remarkably clean and smooth-fitting.

If you would like to look into the possibilities of Bethalume-coated fasteners for resisting atmospheric corrosion, get in touch with the nearest Bethlehem sales office.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

FPC Gets Five Applications for Dams

A total of 732 Mw in generating capacity is involved in five applications for hydro power projects filed with the Federal Power Commission by two private utilities, two irrigation districts and one federated cooperative.

The largest project involves a license application by Appalachian Power Co to build two adjoining power plants on the Roanoke River in Virginia. The pumped-storage plants, to be known as the Smith Mountain Combination Project, would cost an estimated $45-million and have 320-Mw initial capacity.

Public Service Co of Indiana has asked to build an 81-Mw generating plant on the Indiana end of the Markland Dam across the Ohio River, now under construction by the Army Engineers. Power facilities would cost an estimated $24,824,000.

The Oroville-Wyandotte Irrigation District has asked to build a 76-Mw generating plant across the Feather River in California. This project would replace a previously granted (1952) license for a smaller power plant at the same site, which Oroville never built.

Two other applications call only for preliminary preference permits to make feasibility studies. Placer County Water Agency proposes a 230-Mw hydro dam on the Rubicon River and the Middle Fork of the American River in California.

Lewis-Clark G & T Cooperative, Inc., a federation of ten distribution co-ops, proposes a dam on the Yaak River, Montana, with an initial capacity of 25-Mw.

In other hydro developments, Grant County PUD has selected the First Boston Corp to handle the financing of the 620-Mw Wanapum Dam, for which construction bids are scheduled to be called early in 1959. The bond issue is expected to be about $200 million.

Personal Briefs *Cont'd*

dent; **Lee Nickelson,** secretary-treasurer; and **Merl Burgin,** Bloomington, legislative committee; and **George W. Oliver,** Springfield, first vice president.

Michigan-Municipal-Utilities Association has re-elected **Ernest L. Neumann,** city manager of Petoskey, to a second term as president. Other appointments included: **Robert L. Gregory,** vice-president; **J. Bryan Sims,** secretary-treasurer, and **Ralph E. Speer, Jr,** executive secretary of the association.

Monroe G. Smith has been named Vice President to direct Electric Storage Battery's Philadelphia and Kensington, Conn., Divisions.

Department of Interior has established 16 areas which will carry electric power functions in the event of a national emergency. The following have been named directors of the respective areas: **Edward F. Ziegler,** New England Power Service Co, Area 1; **K. M. Irwin,** Philadelphia Electric Co, Area 3; **H. W. Oetinger,** Duke Power Co, Area 4; **James H. Campbell,** Consumers Power Co, Area 5; **George A. Porter,** Detroit Edison Co, Area 6; **Merrill DeMerit,** Tennessee Valley Authority, Area 8; **J. W. Hieronymus,** Commonwealth Edison Co, Area 10; **Charles M. Custer,** Southwest Power Pool, Area 12; and **H. G. Keesling,** State of California, Office of Civil Defense, Sacramento 1, Calif, Area 16. Other appointments were: **J. S. Broaddus,** Salt River Rural Electric Cooperative Corp, power utilization consultant,

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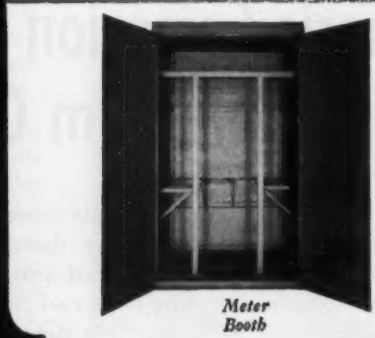
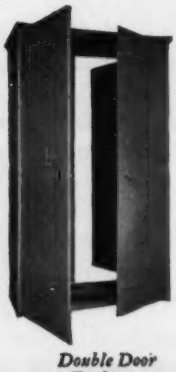


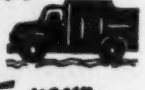
Meter Booth

Current Transformer Enclosure



Double Door Enclosure

Whether a Winch Line Hook or a complete Line Body check ✓ your requirements with



UTILITY TOOL & BODY CO.
CLINTONVILLE, WISCONSIN

Area 8; **Arthur Case,** Nashville Electric Service, deputy director, Area 8, and **E. W. Welch,** Rock County Electric Cooperative Association, power utilization consultant, Area 10.

Two changes in sales executive positions have been made at American Steel & Wire. **Charles P. Greenlee** has been made manager, manufacturers products sales, Cleveland. **Edmond J. Walsh** has been named manager of sales in Detroit.

Allis-Chalmers Manufacturing Co has made these recent organizational changes: **James L. Howell** has been assigned application engineer Norwood (Ohio) Works. **Arthur Doran Brown** has retired after 36 years with the Company. **Charles E. Phillips,** manager of the Wilkes-Barre district for 33 years, has retired.

Sylvania Electric Co has named **Harvey L. Batleman** manager of its Mexico plant.

OBITUARY

Homer Stacey McCollum, 62, retired transmission superintendent of Texas Power & Light Co's Tyler division, died recently.

J. Morris McGrath, 55, secretary-treasurer of the Eastern Shore Public Service Co, died November 3 as a result of a heart attack.

Charles F. Monson, Jr, 46, superintendent of systems operations, Puget Sound Power & Light Co, died recently.

William F. Engfehr of the Wyandotte, Mich., Municipal Service Commission died recently after 21 years of public service.

Carl C. Goings, 70, retired safety director of the Louisville Gas & Electric Co, died recently.

William E. Mitchell, 58, died after a short illness. He was chief auditor for Ohio Edison Co for 29 years.

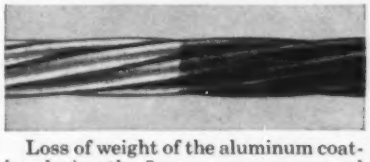
Wilford Orus Cluff, 60, sales manager for Utah Power & Light Co died in his home of coronary occlusion.

(Advertisement)

Rugged 5-year field test proves superiority of ACCO ALUMINIZED Strand

Convincing proof of ACCO ALUMINIZED Steel Strand's matchless ability to "stand up" in highly corrosive, heavy industrial areas is furnished by a 5-year field test recently completed by a leading Eastern power company.

A section of ACCO ALUMINIZED High Strength Guy Strand, installed in 1953, was removed and subjected to thorough examination, including various laboratory tests and measurements. The wire surface was covered with a formation of sulfide, oxide and soot; but, after scrubbing with soap and water, the aluminum coating was shown to remain *bright, smooth and unattacked* by the highly sulfurous atmosphere (*see photo*).



Loss of weight of the aluminum coating during the 5-year exposure proved negligible. Tests showed that the physical properties of the wire and coating continuity were exceptionally good. All in all, the determinations indicated that the ACCO ALUMINIZED Strand would give *many additional years of outstandingly satisfactory service.*

"Far Greater Life..."

In another test, the ability of PAGE ACCO ALUMINIZED Strand to withstand exposure to extreme salt atmospheres is proved, as revealed by the following excerpts from a letter written by an official of a public water authority:

"We have obtained excellent results with ACCO ALUMINIZED guy wire. We ran several tests in the Metropolitan Area where there was exposure to the salt atmosphere from the sea. We used galvanized strand and your (ACCO ALUMINIZED) strand on the same poles.

"Results indicated *far greater life* for ALUMINIZED. After 8 months, the galvanized was rusted, whereas the ALUMINIZED showed no signs of oxidation or deterioration. As a result of our tests, our original purchase of ACCO ALUMINIZED guy wire was followed by another, and larger, order. This wire is used where we must have a product with high resistance to corrosion."

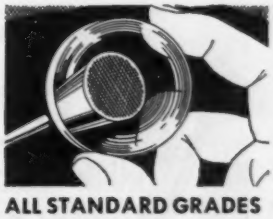
PAGE STRAND

of ACCO ALUMINIZED STEEL

In 1954, PAGE announced to the industry the successful development of a process for combining two time-tested but dissimilar metals, on a production basis, into a revolutionary new wire for increased resistance to corrosion: *Steel* for strength coated with *Aluminum* for corrosion-resistance.

Early laboratory results on accelerated Salt Spray testing which were favorable to ACCO ALUMINIZED over galvanized by a wide margin, are now being confirmed by results of field tests on installations of ACCO ALUMINIZED Strand exposed to the elements over a period of 3 to 5 years. The remarkable performance of the product in both industrial and marine atmospheres is now assured.

Now PAGE offers ACCO ALUMINIZED Steel Strand for guy wire, ground wire and messenger wire. Available in a wide range of sizes, in 3-, 7- and 19-wire construction. It can be used with Preformed Guy-Grip dead-ends made of ACCO ALUMINIZED Wire, or with galvanized pole hardware.



ALL STANDARD GRADES

PAGE ACCO ALUMINIZED Steel Strand is available in Common, Siemans-Martin, High Strength, Extra High Strength, and Utility grades with physical properties meeting ASTM Spec. A-122-54-T and A-363-55-T.

Other PAGE Wires of ACCO ALUMINIZED Steel

ACSR Core Wire

PAGE ACCO ALUMINIZED ACSR Core Wire is now available from leading manufacturers of aluminum conductor cable.

Chain Link Fence

PAGE Chain Link Fence of ACCO ALUMINIZED Steel Wire fabric, provides longer-lasting protection at a long-range saving.

Also... ACCO ALUMINIZED Telephone and Telegraph Wire, Barbed Wire —and other products

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INDIANA STEEL & WIRE CO.
Crapo
Galvanizing
MUNCIE, IND.
Signs along the lines of Crapo GALVANIZED STEEL STRAND PERFORMANCE
For dependable performance . . . insist upon Crapo Galvanized Steel Strand. Superior tensile strength, combined with long-life, ruggedness and workability, makes Crapo Steel Strand first choice for guys, messenger and overhead ground wire.
The famous Crapo galvanizing process provides dependable protection for the steel, prolongs the expectant life of the strand.
• Low maintenance cost
• Laboratory tested and controlled quality
• Meets highest quality standards
• A size and grade for all practical needs
• Contact your Crapo Jobber—Today!
INDIANA
STEEL & WIRE CO., INC.
Muncie, Indiana

• Essential for Electrical Men

Another FIRST FOR THIEL IN THE NEW HUMP DRIVE NAIL-IT STRAP. THE HUMP HAS A STURDY HEAD TO INSURE EASY-DRIVE WITHOUT BENDING OR PULLING OUT. MADE OF #8 HEAVY WIRE. ZINC PLATING PREVENTS RUST.

COPPER PLATED FOR PLUMBER'S USE — AVAILABLE SOLD ONLY THRU LEADING ELECTRICAL WHOLESALERS.

THIEL TOOL & ENGINEERING CO., INC.
1417 N. MARKET ST. LOUIS 6, MO.

SEE Engineers Scan Future

(Continued from page 30)

service facilities. Duke Power experience with its promotion since May has been favorable, Huff said.

In discussion R. C. Daffron said that Virginia Electric & Power Co adopted the service riser promotion in May, 1956. Now 55% of all residential services installed are 100 amp minimum capacity. Vepco installs the risers for services up through 200 amp. Larger single-phase and all three-phase services are installed by contractors.

Common grounding of telephone and power systems provides safety to the public and workmen and reduces damage to plant caused by contacts between the two systems. Thus, E. J. Bonnesen, American Telephone & Telegraph Co, recommended bonding of both systems at every vertical ground lead as "about the only safe way to operate."

P. C. O'Shee said that Alabama Power Co favors joint bonding, however he emphasized that both facilities should be on the same joint-use pole. They should not be on separate pole-lines, as advocated by the Telephone Div of R.E.A. because of numerous operating, legal, and union jurisdictional problems. He urged that utilities recommend common bonding on joint-use poles to code authorities and, in so doing, reduce the presently required clearances. "Why is it necessary to have more than 12-in. spacing," O'Shee asked. Bonnesen replied that he could not speak for AT&T but personally he thought 12 in. may be too small because of working space.

Serve 8 Homes Per Transformer

Most economical scheme for residential underground distribution is to run separate services to eight homes from a single transformer. F. C. Van Wormer, General Electric Co, said that this system of direct buried services and transformers in semi-buried enclosures was suitable for demands of 4.8 kva per customer and higher (in groups of 16). By eliminating secondaries the scheme: Reduces voltage dip complaints from motor starts; obviates the replacement of secondary because of inadequate size, and improves service continuity because faults on any service can be cleared by a limiter rather than the transformer fuse.

A definite trend is developing to no-tap transformers in single-phase sizes up through 50 kva, H. L. Deloney, Louisiana Power & Light Co told the distribution session. "It appears that most users can find sufficient economic and operating justification to abandon the purchase of tapped transformers in popular sizes." Advantages include a 10% saving, elimination of major sources of transformer failure due to trouble in tap changers and moisture entry, and paves the way for completely sealed transformers.

Compare Transmission Tower Types

In comparing the cost of steel, wood and concrete as transmission structures, E. S. Zobel, American Electric Power concluded that wood provided the lowest cost for single circuit structures; steel for double circuit towers. Concrete structures are too new to be fairly evaluated. He noted however that wood structures have to be replaced at the end of 25 years and again after 50 years, together with associated hardware.

W. E. Farris described a high-side transformer bank protective scheme developed and used on the Georgia Power Co 110-kv subtransmission system in lieu of a costly 115-kv OCB, switch, and relay system. The scheme uses a grounding blade, actuated by differential or backup OC relays to fault the line and transfer the condition from within the substation to the source breakers. The scheme utilizes a group-operated disconnecting switch equipped with a spring operator, in conjunction with the grounding blade, for automatic opening. Low side feeder breakers are tripped on differential to avoid feed-back.

N. H. Erlandson, Carolina Power and Light Co told the transmission session that rising cost of rights-of-way may justify increased use of steel tower lines. This, he suggested, may make it desirable to review steel tower design to reduce lightning tripouts. Erlandson said, Carolina P&L shielded H-frame 110- and 132-kv lines have fewer tripouts due to lightning than steel tower lines. Installation of counterpoise reduced these tripouts, Erlandson said, and offered some advantages over ground rods in lowering structure resistance. On tower lines with

adequate shield wires and a low enough footing resistance, flashovers can be restricted to one circuit if the insulation differential between the two circuits is equal to two times normal crest voltage.

An unusually thorough analysis of criteria for wind loads on transmission and substation structures was presented by J. P. Thompson, National Bureau of Standards. The most important detail in designing structures for wind loads, he said, is selection of the basic pressure to be applied. Handbooks generally give only an abbreviated method of determining this basic pressure, and in the absence of a full explanation, the precise meaning of these formulas is uncertain. For this reason Thompson took pains to review data and conditions involved in developing the wind-load map and factors recommended in the American Standard Building Code Requirements A58.1-1955.

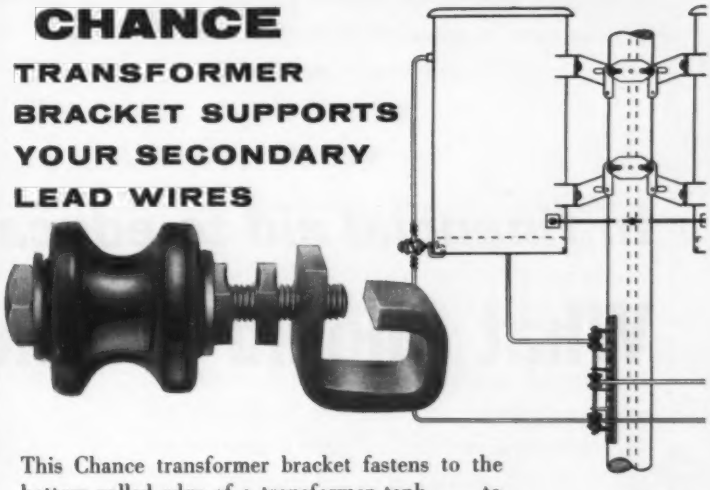
On the Virginia Electric & Power system, chemical brush control has been proved the most practical, economical and satisfactory method of R/W maintenance. Present hand cutting-machine mowing cost is $17.50 per acre per year compared with an ultimate chemical application cost of $8.00 per acre per year, based on progammed application. G. T. Robbins said value of the company's danger-tree removal program was demonstrated during hurricane Hazel when not a tree or limb damaged the company's transmission system. In the past 8 years the Virginia company has cut 1,900 trees a month.

C. T. Wanzey told the SEE generation session that use of flyash in concrete has saved Duke Power Co $1.06 per cu yd of concrete for additions to Allen Plant. This saving resulted from the replacement of 25% of the cement by weight and takes into consideration depreciation on the special flyash handling facilities. Flyash from hoppers installed with the first two units at Allen is conveyed, in pipes under vacuum, to the mixing plant. Here, it passes through a batcher to the mixer and to the concrete pump. Excess ash may either be stored or diverted to a chute for loading railroad cars or trucks. Cost of the plant was $29,000 of which $20,500 was for equipment and $8,500 for labor.

(Continued on page 82)

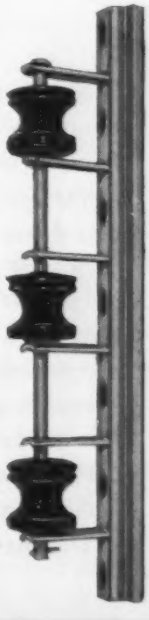
Here's a NEW item in Pole Line Hardware

CHANCE
TRANSFORMER BRACKET SUPPORTS YOUR SECONDARY LEAD WIRES



This Chance transformer bracket fastens to the bottom rolled edge of a transformer tank . . . to serve as a firm support for secondary lead wires. Designed to fit all popular distribution transformer tanks, the sturdy hot-galvanized steel clamp and bolt can be quickly and easily attached. Bracket furnished with brown glazed porcelain insulator assembled.

P. S. *Distribution engineers can devise many other uses for this secondary lead bracket.*

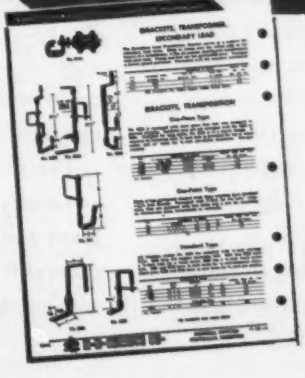


STURDY, ECONOMICAL SECONDARY RACK

Available in light and medium types, this secondary rack features the sturdy, economical staking method of joining the points to the back. The light type is designed for secondary network duty and relatively light loadings, while the medium type is used for intermediate loadings. Made of heavy gauge hot-galvanized steel, the racks are shipped with insulators disassembled unless otherwise specified.

CP58-15

Find hardware information in a HURRY!



"Dictionary style" alphabetized catalog pages enable you to find pole line hardware items quickly from four general sections—Guying Materials, Electrical and Communication Line Hardware, Cable Hardware, Grounding Materials. See your Chance Catalog or send for pages today.

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In financial aid to education . . .

What Should Business Do Now?

Now that the federal government is entering the field, should business firms stop giving financial aid to our colleges and universities?

This question is now being discussed by business directors throughout the country. The discussion is prompted by the near-billion-dollar program of federal aid to education passed by Congress a few months ago. For if the federal government, with its access to billions in taxes, is assuming responsibility for the financial welfare of education, should not business get out of the way and let the government take over? This is the general way the question is being asked.

The answer is a resounding NO.

What The Federal Program Does

The new federal program makes it possible for the government to spend the imposing total of $900 million for aid to education over the next four years. There are still many loose ends in the program. But already it's quite clear what such funds will — and will not — do to help relieve the financial plight of our colleges and universities.

First of all, the program is not going to solve any financial problems in education overnight. The program is just barely underway. So far no money has actually been allocated, and Congress has appropriated only $40 million — less than 5% of the total.

More important, there is very little in the total program which will result in direct aid to colleges and universities. The program does set up fellowships to train college teachers. But most of the aid will eventually be channeled through the states to primary and secondary schools. The main focus of the program is education for national defense — strengthening science, mathematics and foreign languages in elementary and secondary schools, together with grants for counseling, testing and research.

The one big item for higher education is a $295 million student loan program, which will help needy students pay tuition and other fees. But tuition rarely covers the full cost to the college of educating a student. So the net result could well be an additional financial strain on our institutions of higher learning.

For the three most pressing financial needs — faculty salaries, scholarship grants and new plant and equipment—colleges and universities must still rely heavily on help from the business community. And it would indeed be a major

misfortune if the recent actions of the government put a blight on this growing and substantial support to higher education.

In the last ten years, business has expanded its financial aid to education by more than four fold. In 1948, contributions were only $24 million. In 1957, such aid reached an estimated $125 million. Moreover, corporations have been putting a larger proportion of their total charitable gifts into education. In 1950, the percentage was only 17%. By pre-Sputnik 1956, the share had already increased to 34%, according to figures recently released by the Council for Financial Aid to Education.

Why Business Must Help

The most compelling reason for increasing business aid to higher education — at an even faster rate—is that our colleges and universities desperately need financial help. It is that simple. Private contributions to higher education must average at least $400 million over the next ten years if our colleges are to meet rising operating costs and raise faculty salaries to decent levels. Despite the growth in business contributions, we are still well below that goal.

If our colleges cannot solve their mounting financial difficulties through voluntary help from business firms, alumni and communities — then it is to be expected that federal aid ultimately will be mobilized in a big way. In principle, if not in dollars, the 85th Congress has paved the way. Indeed, a large federal scholarship program was squeezed out of this year's legislation only in the course of last-minute compromises. And Arthur S. Flemming, Secretary of Health, Education and Welfare, has urged that the next session of Congress restore the scholarship program.

About any federal rescue operation for higher education, two things are quite clear:

(1) **Such aid will come too late to prevent irreparable harm resulting from the current shortage of funds.** The need for help is urgent and immediate.

(2) **With federal taxes taking over half of all corporate income, any federal program in the end will be financed in large part by the business community.**

An Opportunity

So, viewed narrowly, it is in the selfish interest of business firms to aid our colleges and universities now, rather than wait and be forced to pay later on. By doing so, they ensure that business will have a continuing supply of well-trained graduates. They take advantage of the tax laws for charitable contributions which mean the government in effect assumes more than half the cost of business aid to education. And they win gratitude for a voluntary and generous act.

Viewed in the broad public interest, the business community has an opportunity to perform a financial rescue mission in education which could well be the key to successful survival, not only of our present system of higher education, but also of the nation itself.

As previous editorials in this series have pointed out, a very small share of the net income of business firms — about 1% — would do the job. Certainly business must not be distracted from this opportunity by the new venture of the federal government in financial aid to education.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nation-wide developments. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C. McGraw

PRESIDENT

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SEE Engineers Scan Future *(Continued from page 79)*

Start-up problems with two 125-Mw units at Lauderdale Plant were enumerated by J. W. Keck, Florida Power & Light Co. Among the major troubles with the 1,450 psig 1,000/1,000F units were these:

1. Accumulation of trash in the governor orifice, cup valve, and servo piston pilot valve. Resulting erratic operation was eliminated by frequent cleaning. In the second unit it was avoided by flushing the control system with oil delivered in sealed drums and pumped through inspected pipes.

2. Excessive vibration at loads above 90 Mw was caused by a standing wave from the furnace to the gas outlet of the boiler. The resonance was overcome by installing a turning vane at the boiler outlet; altering the wave length.

3. Seizure of heater drain pumps following sudden load drops caused by flashing due to insufficient suction head. Trouble was eliminated by installing pressure differential switches between the discharges of the pumps and the down-stream side of the regulating valve to the boiler feed pump suction header.

The quality of coal is a basic problem facing the boiler designers and operators today, according to Charles L. Richards, Combustion Engineering Co. Ash, sulphur, slate, and alkalies in coal and in blends from different sources contribute to expensive boilers and high operating and maintenance costs, Richards said. He urged that operators know what coals are being burned at all times to permit adjustment of equipment for good operation and avoid possible shut-downs.

Penalties against lack of spare capacity in boiler feed pumps are sufficient to make the economics of providing such capacity worth considered, J. J. Heagerty, General Electric Co said. Spare capacity should be equal to the largest pump, he said. This rule is based on a study of the effect of changes in plant reliability caused by different numbers and sizes of pumps.

Efficiency of 113% is obtained from pump storage at Rocky River hydroelectric plant due to the seasonal storage characteristics, said C. T. Hughes, Connecticut Light & Power Co. Practically all pumping is done in the spring during high run-off. About 14% of the water is pumped when water is spilling at two hydro plants downstream. Thus, the seasonal storage characteristic not only firms up the Rocky river plant but also the two plants downstream.

R/W Men Meet With Engineers

The newly-created Real Estate Section of SEE held its third meeting at Roanoke concurrently with sessions of the Engineering and Operating Section. Discussions during the two-day meeting centered on ways to meet rising right of way costs, rear-lot-line distribution agreements, devices for smoothing R/W acquisition, and condemnation.

Discussion of ways to cope with rising R/W costs was led by Richard Seawell, Carolina P&L Co. Recommendations were these: **1.** Plan ahead: Sudden changes in plan and lack of funds to purchase for future needs can limit benefits; **2.** Study land use along proposed locations, secure aerial photos in advance, check for changed ground conditions, **3.** Select location only after careful study of land uses; balance R/W cost with construction cost and maintenance needs. **4.** Allow ample time for acquisition.

Need for devices that smooth R/W acquisition was particularly emphasized by the real estate men. Visual aids that help land owners and developers visualize transmission lines in relation to developments and community plans are particularly helpful. T. E. Carter showed scale models that have been effectively used by Florida Power & Light Co to negotiate R/W acquisition.

Although rear lot line distribution is unpopular with Louisiana Power & Light Co it is still built and will continue to be, George P. Marse said. However, maintenance of underground street lighting by the developer is a prerequisite. A review of policy on rear lot line practice has led to elimination of mortgage subordination, Marse said. The company now permits fences across rear lot R/W where formerly they prohibited any building and required access by trucks via an alleyway. Customer objection to alleyways has led to their elimination in new developments.

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Readers Forum

"Not What Is Right"

To the Editor:

I was much interested in your "Editorial Comment" of September 15, 1958, regarding Government owned power systems. The thing that interested me most was your statement that this problem has been ranked as Number One among the utility executives. Frankly, I think both the utility executives and ELECTRICAL WORLD have been prone to take this matter entirely too lightly for many years.

If my memory serves me correctly, ELECTRICAL WORLD published an article several years ago in which it stated that during a recent vote the vote was overwhelmingly for private enterprise. If I remember the percentage correctly, it was approximately 66%. To think that 34% of the people could be for anything but private enterprise to me is most alarming, and I believe utilities have got to look at it in this light if they are going to stop the gradual encroachment of Federal Government into State and personal affairs.

When I returned to my former utility company after four years in military service and told one of our executives that I would like to "preach the gospel" of private enterprise, I was told at that time that they had no fear of federal power any more. I am no longer connected with a utility, but I still believe in the privately owned utilities. I do not think enough of the people in the utilities really feel as strong as I do and too many are thinking only of themselves, not what is right. . .

W. W. Archer

15 Robin Road
Richmond, Virginia

Cost of Accidents

To the Editor:

Your editorial, "The Economic Waste of Accidents," in the August 18 issue of Electrical World calls attention to a very important aspect of safety which, as you have very ably pointed out, is being neglected. In industry the dollar sign is a very powerful mover. The dollar cost of accidents, instead of being neglected, should be receiving special attention because accident costs are increasing at a more rapid rate than other costs. This will, no doubt, continue until industry comes to the full realization that accidents are too costly to afford.

Focusing attention on this aspect of accident prevention on the editorial page of Electrical World will, no doubt, bring it forcibly to the attention of many management people and thus stimulate their thinking. For this service and the interest in safety which stimulated it, the EEI Accident Prevention would like to thank you.

There are, of course, reasons why management has not been more cost-conscious about accidents. First, accurate accident costs are difficult to obtain because of the many intangible factors involved and because the major portion of the costs are indirect and therefore difficult to even list without attempting to give them a monetary evaluation.

Second, the ratio of indirect to direct cost is variously estimated from one to one to five to one, four to one being the ratio commonly used. Presenting a case for safety, supported by cost figures consisting of 20% actual and 80% estimated, is apt to be very unconvincving. Such data gives the impression of "building up a good case" and puts a proposal based thereon behind a physological "eight ball." The boss man accepts the 20% actual cost at face value but the 80% estimated or indirect cost is accepted only with serious reservations.

Third, since the ratio of indirect to direct cost of accidents is not a firm ratio, attempting to use accident costs as a leverage to promote safety is like prying with a rubber crow bar. The lever is not very rigid and doesn't do much moving.

In spite of these and other obstacles, accident costs are not being fully exploited to sell the need for safety to management and employees, as you have pointed out.

I. R. Dohr, Chairman
EEI Accident Prevention Committee

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Advertising Index

Allis-Chalmers Mfg. Co. ..... 4th cover, 56, 57
American Chain & Cable Co. Page Steel & Wire Div. 77
Bethlehem Steel Co. 75
Blackburn Corp., Jasper 43
Chance Co., A. B. 79
Chevrolet Div., General Motors 47
Directory of Engineers 82
Dowell 73
Duncan Electric Co., Inc. 55
Electro-Motive Div., General Motors Corp. 70, 71
Engineers, Directory of 82
Federal Pacific Electric Co. 10
General Electric Co. Apparatus Dept. ..... 2nd cover, 39, 41
Communications Dept. 19
Graybar Electric Co., Inc. 7
Grinnell Co., Inc. 4
Indiana Steel & Wire Co., Inc. 78
Kaiser Aluminum & Chemical Sales, Inc. 20
Kellogg Co., M. W. 18
Lapp Insulator Co., Inc. 6
Leeds & Northrup Co. 74
Line Material Industries 15
McCabe-Powers Body Co. 59
Moloney Electric Co. 22
Ohio Brass Co. 21
Page Steel & Wire Div., American Chain & Cable Co. 77
Pennsylvania Transformer Div. McGraw-Edison Co. 8, 9
RT&E Corp. 16, 17
Roebling's Sons Corp., John A. 62
S&C Electric Co. 52, 53
Searchlight Section 83
Simplex Wire & Cable Co. ..... 3rd cover
Standard Transformer Co. 68
Stone & Webster Engineering Corp. 67
Superior Switchboard & Devices Co. 76
Thiel Tool & Engineering Co., Inc. 78
Utility Tool & Body Co. 76
Victor Insulators Div. I-T-E Circuit Breaker Co. 49
Wagner Electric Corp. 45
Westinghouse Electric Corp. 50, 51, 60, 61

PROFESSIONAL SERVICES 82

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EQUIPMENT (Used or Surplus New) For Sale 83

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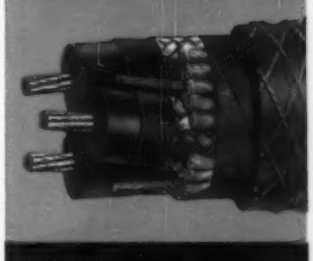

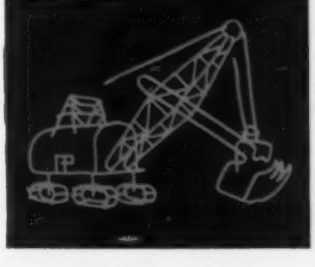

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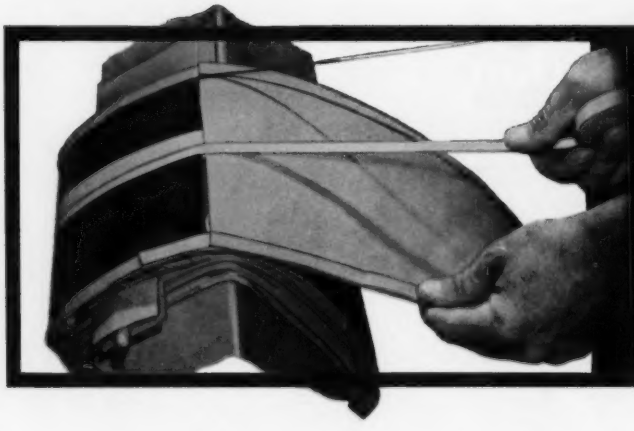

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